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CARCINOMA OF THE CERVIX TREATED BY ROENTGEN-RAY AND RADIUM

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IN a paper with a similar title published in 1937 in the *Annals of Surgery* 70 cases of cancer of the cervix treated with x-ray and radium were presented that had been followed for 3½ years. At that time charts were made which showed that a follow-up from 2½ to 3 years after treatment might be long enough for a satisfactory end-result study. In this paper these 70 cases have now been traced for 5 years and over, the results are given, and the charts have been brought up to date. During the study of these cases other interesting facts were found concerning the microscopic appearance of the radiation reaction and the importance of the genito-urinary tract complications. These findings will be taken up later in this and succeeding papers in more detail.

TREATMENT

The treatment as given in the Pondville Hospital consists of x-rays given through 4 pelvic portals, 8 by 10 or 10 by 10 centimeters, 2 anteriorly and 2 posteriorly. The rays are directed obliquely at the cervix and parametrium by means of a centering device. Each field receives a total of 1,500 to 2,000 r units (air measurement), the total dosage depending upon the rapidity with which the treatment is given. Daily exposures of from 300 to 400 r are used, alternating the fields so that a given area receives 1 exposure every fourth day. The machine setting is as follows: 200 kilovolt peak; 5 to 20 milliampere depending on the capacity of the apparatus; ½ millimeter copper and 1 millimeter aluminum filter, 50 centimeters of focal skin distance. The treatment averages about 18 days. At the end of that time the patient is given radium treatment. Radium in a small emanation needle is placed in a platinum applicator 1 millimeter in thickness. This is inserted into the cervix for a total dose of 1,500 millicurie hours, the treatment lasting about 5 hours. Four days later the same treatment is repeated. There is very little systemic reaction and there has been practically no bladder or rectal irritation and no slough in the vagina. This is in marked contrast to the old method of treatment that was used, namely, gold seeds in the periphery of the cervix and a silver cylinder in the canal.

Since using the slower type of treatment with x-ray and radium the patients have been more comfortable and their convalescence, after leaving the hospital, has been much easier. We believe that this type of

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treatment delivers more effective radiation about and around the cervix than can be delivered by radium alone. We feel that areas of tumor on either side of the cervix are certainly reduced in size and may be destroyed. The field of radiation in the broad ligaments and about the cervix before the radium is given is well walled off by tissue reaction and fibrosis. Therefore, trauma of the cervix from curetting or application of radium will not cause extension of disease. Because of the roentgen dosage it is not necessary to give huge doses of radium in the cervical canal. Only when we have increased our radium over the usual dosage have we had trouble in the bladder or rectum. At the time of the first radium application, which is given under an anesthetic, it is usually obvious that the x-ray treatment has created a great change in the cervical tumor and the broad ligaments are more fixed. There is thickening, tightening in the ligaments, and the tumor is usually shrunken with occasionally nothing but a crater left in the apex of the vagina. The vaginal discharge is lessened and infection clears up. The application of radium is usually less but occasionally more difficult than it would be with the original tumor present. The weakness of our method of treatment lies in the radium plan, in that masses on the vaginal walls are not given sufficient treatment. Recently we have been trying to remedy this by the use of interstitial radiation in the vaginal wall extensions given in the form of platinum needles, 2 to 10 milligrams in strength with 0.5 millimeter platinum filter, but not adding over 1,000 millicurie hours to the total radium treatment.

It has been possible to carry out our treatment satisfactorily by means of house officers. Because Pondville is located 20 miles from Boston it is impossible to have a visiting surgeon treat every patient, so that we have had to make the treatment as foolproof as possible. Much to our delight there have been no calamities and the results show that this form of radium treatment is safe in the hands of a surgically trained house officer.

Material. The cases used for analysis in this report are those of all types, early and late, that came to Pondville, who were able to take the treatment as outlined. If a patient were so feeble that after a few attempts at x-ray treatment it was found we could not continue, she was not included in this series. In other words this is a relative rather than an absolute group, but not a selected one. In reading the recent reports on the subject it is evident that in nearly every clinic, cases that are too far advanced are discarded and their statistics are relative. Relative statistics and not absolute ones are the more important because it is not possible to give x-ray and radium treatment to all patients as some are *in extremis*, and others have been treated elsewhere and should not be included.

That our relative figures are fair is shown in the type of patients treated. There were but 8 cases in the operable groups, the so called A and B of the American College of Surgeons, as against 62 in the advanced C and D groups. This makes it clear that cases were not picked.

Repetition of treatment. Cases with suspected recurrence of disease are occasionally treated again, usually by means of roentgen treatment but also by means of radium. This treatment is given any time after 3 months from the original radiation. It is obvious from a study of these cases that many of the re-treated patients did not have a recurrence but were found to have broad ligament thickening and were therefore given more radiation. From now on no re-treatments will be given without positive evidence of cancer. Of the cases that were re-treated in this clinic 10 have lived and 27 have died. It is our feeling that the 10 that lived had no disease and that the remainder did have disease at the time of re-treatment. Much more care should be exercised in ruling out radiation reaction because more radiation causes discomfort and frequently disaster.

Results. At the end of 5 years 5 out of 5 A cases, or those with disease limited to the cervix, have survived, representing a percentage of 100; of the 3 B cases, or those with disease involving the cervix and vagina, 100 per cent were alive after 3½ years; 1 patient has since developed a recurrence and is called dead, dropping the percentage to 66.6. Of the 45 C cases, or those with disease involving

TABLE I.—COMPARISON OF STATISTICS

Author	Year reported	Total treated	Periods treated	Living and well for 5 years								Relative cure all stages	
				A		B		C		D			
				No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Lacassagne. Institut du Radium, Paris	1937	111	1930	12	75	19	56	16	34	5	35.7	52	46.8
Hurdon. Marie Curie Hospital, London	1937	136	1930	5	83.3	21	65.6	27	35.3	3	17.6	56	41.2
Pitts and Waterman. Providence, Rhode Island	1937	77	1929–1930	6	100	13	59	9	27.2	0	0.0	28	36.3
Pondville	1938	70	1931–1933	5	100	3	66.6	16	35.5	1	5.8	24	34.3
Ward and Sackett. Woman's Hospital, New York	1938	572	1919–1932	10	62.5	58	55.2	95	22.6	0	0.0	163	28.5
Healy and Frazell. Memorial Hospital, New York	1938	551	1928–1931	50	58	30	38.4	68	22.0	5	6.3	153	27.7

the cervix, vagina, and broad ligament, the percentage is exactly the same, 35.5. Of the 17 D cases, or those with complete fixation of the pelvis or remote metastases, and who are considered inoperable and hopeless, 1 survives, a percentage of 5.8. Thus the total salvage is 24 out of 70 cases, or 34.4 per cent.

COMPARISON WITH OTHER CLINICS

On comparing the results of some of the leading clinics in Europe and the United States with the Pondville series (Table I) it is interesting to note the position of Pondville. Pitts and Waterman in their last series treated by their new method, using long platinum needles of low intensity, have done slightly better than the Pondville series.

Analysis shows that the Pondville series, taken group by group, is better than that of Pitts and Waterman; but because they have so many more early cases than those in the Pondville series, their total percentage is better. This demonstrates that comparative studies ought to be made upon equal numbers per group and not total numbers of cases. In their series the A and B groups contained 28 cases and the C and D groups, 49; whereas in the Pondville series the A and B groups have only 8 cases, and the C and D groups, or advanced cases, 62 cases. Thus it is fair to say that the Pondville type of treatment is an improvement over that of Pitts and Waterman. In Europe the clinic of Lacassagne at the Institut du Radium in Paris has a good deal higher percentage of curability, and the clinic of Hurdon at the Curie Hospital in London is next best. We recognize that the small number of cases at Pondville cannot compare with the huge series of Ward and Sackett at the Woman's Hospital and that of Healy and Frazell at the Memorial Hospital in New York. It is interesting to note in this table that the results of the early cases are about the same, except in the 2 largest series. It is also of interest to note that the 2 European clinics increase the number of their cures by better results in the more extensive lesions, especially the very extensive. Among the American clinics there is a 5.8 per cent curability of the D cases at Pondville, none at the Woman's Hospital in New York, and 6.3 per cent in the Memorial Hospital in New York; whereas Lacassagne reports 35.7 per cent, and Hurdon 17.8 per cent cured. It might be assumed that we are more particular in the choice of our cases for our extensive group; but even if Lacassagne and Hurdon were not so particular as we in the choice of that group and placed their D survivors in Group C, their C results would make our figures in that class not as satisfactory as they should be. It is therefore probable that Lacassagne and Hurdon are better able to distribute their radiation in the pelvis and about the cervix than we are with our present plan of treatment. The improvement in the Pondville series over other series that have been reported in Boston, namely, from the Massachusetts General Hospital and the Huntington Hospital, is in the C class. Cases in this group are supposed to have infiltration in the broad ligament. It is possible that what

TABLE II.—FIVE YEAR END-RESULTS, OPERABLE AND INOPERABLE GROUPS—"PONDVILLE TREATMENT"

	Distribution by classes		Alive—no disease	
	No.	Per cent	No.	Per cent
Operable				
A	5			
B	3	11	7	87.5
Inoperable				
C	45			
D	17	89	17	27.4
Total	70	100	24	34.3

has happened is that patients we felt were Class C cases, with extension into the broad ligaments, may have had inflammatory masses in the pelvis rather than malignant disease.

CHARTS

In comparing the present charts with those in the previous article great similarity is shown. All charts, figures, and statistics have been reviewed by Dr. Herbert Lombard of the Massachusetts State Department of Public Health, who is responsible for the supervision of statistical papers published from the Pondville Hospital. He is satisfied that the curves in our charts are correct and believes that these charts may be used, as we suggest, as prognostic indicators. He considers this an extremely important contribution. In Chart 1 it will be noted that the curve starts from the onset of the disease. This is reckoned for each patient as 8 months, as that was the average time of onset in all cases. To obtain the average duration of symptoms the total number of months of symptoms of all 70 cases were added together and the total divided by 70. In a large series of cases this may be considered accurate. Considering the onset in all cases with disease 8 months before treatment, Chart 1 carries on from the onset to 5½ years later. It will be noted that at the end of 3 years the curves are practically parallel. The curve of the untreated patients ends at death at 5½ years, but the other 2 curves, representing a huge series of cases from Pondville and from the Huntington Memorial Hospital and the combined cases from the Massachusetts General Hospital and Pondville, show only a very slight variation from one another from 2½ to 5½ years. It appears as though there was not going to be a sudden drop. Each curve falls about 15 per cent in the last 2 years. In other words, if we follow our cases for 3 years from onset of disease and then subtract 15 per cent for the next 2 years, we can predict the percentage alive at the end of that time.

Chart 2 shows the same series but now the group of cases from Pondville and the Massachusetts General Hospital are separated. Here again it is evident that there is a very slow but regular decrease of cases from the 3 year interval until 5½ years are reached. The curves do not drop suddenly, they decline gradually, almost perfectly parallel. This must mean that the end-results can be predicted after 3 years have passed from the onset.

Chart 3 is very important for it includes a series of radium treated cases from the Massachusetts General Hospital which were followed for 8 years after treatment and a similar

TABLE III.—FIVE YEAR RESULTS IN EARLY CASES—BOTH METHODS OF RADIATION GIVE BETTER RESULTS THAN SURGERY

	Per cent
Pondville (x-ray and radium)	87.5
Massachusetts General Hospital (radium)	64.3
Massachusetts General Hospital (surgery)	46.1

TABLE IV.—COMPARISON OF FIVE YEAR RESULTS—RADIATED CASES

		Pondville		Massachusetts General Hospital	
		5 year cures		5 year cures	
Groups	No.	No.	Per cent	No.	No.	Per cent
A	5	5	100.0	15	12	80.0
B	3	2	66.6	13	6	46.1
C	45	16	35.5	102	16	15.6
D	17	1	5.8	20	0	0.0
Total	70	24	34.3	150	34	22.6

The results of the Pondville series are compared by classes with the Massachusetts General Hospital series. Pondville has improved the results in all classes.

TABLE V.—DISTRIBUTION OF CASES

	Classes			
	A and B		C and D	
	No.	Per cent	No.	Per cent
Pondville (x-ray and radium)	8	11	62	89
Massachusetts General Hospital (radium)	28	19	122	81
Massachusetts General Hospital (surgical)	39	65	21	35

In this table it can be readily seen that the types of patients in the Pondville series were more advanced than those seen at the Massachusetts General Hospital, fewer early cases and more advanced ones.

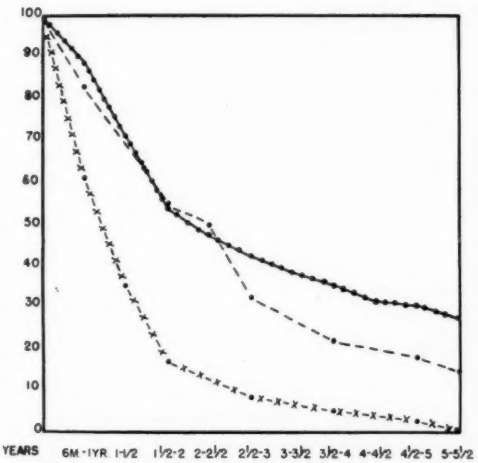

Chart 1. This chart shows 2 series of cases plotted against a series of untreated carcinomas of the cervix. The same general trend is obvious. After 3 years the 2 treated series, 1 a very large group treated with radiation by various surgeons, and the other a group treated by the same surgeons at the Massachusetts General Hospital and Pondville Hospital, show the same general trend. •-•-•-•-• M. G. H. radium and Pondville combined, 220 cases; - - - - - treated (Welch and Nathanson), 2192 cases; -x-x-x- untreated (Welch and Nathanson), 67 cases.

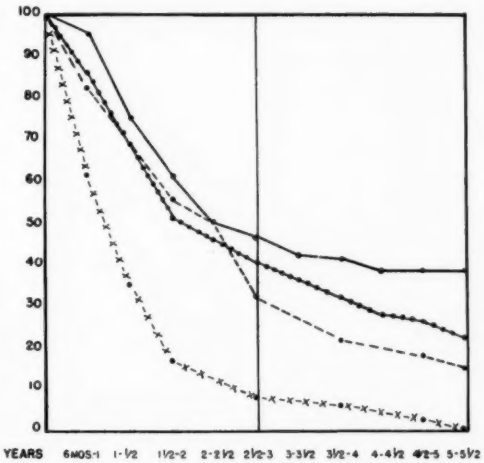

Chart 2. In this chart the Massachusetts General Hospital and Pondville Hospital series have been separated. Beginning at 3 years the same slow downward trend is evident. •-•-•-•-• M. G. H. radium, 150 cases; ——•—— Pondville, 70 cases; -x-x-x- untreated (Welch and Nathanson), 67 cases; - - - - - treated (Welch and Nathanson), 2192 cases.

but larger series from the Radiumhemmet. Included in this chart, to show how closely all curves parallel, are the Pondville cases and the larger Massachusetts General Hospital series. The 2 longer series starting at 3½ years after treatment are nearly parallel for the next 4½ years. There is no sudden decrease and the deaths, in most instances classified as cancer deaths, are not greater than the fall of the life expectancy curve at this age. It is more than probable that most deaths in the later years were due to causes other than cancer. The group from Pondville and the Massachusetts General Hospital followed but 5 years have the same general trend and from our experience will continue to diminish less than 2 per cent per year for the next 3 years. It is the feeling of the authors that this group of curves definitely refutes the suggestion that radium treated cases are not as sure of permanent cure as surgically treated ones.

Chart 4 in another and perhaps more graphic manner tells the same story. The groups discussed under Chart 4 are tabulated in graph form. The first 2 years are obviously the serious years for patients with cancer of the cervix for in the third and fourth years, respectively, less than 9 per cent of the total number of cases, not including the survivors, died. In the fifth year not over 5 per cent died, and in the sixth, seventh, and eighth years not over 2 per cent. Thus it is evident from these various charts that end-results in a series of cases of cancer of the cervix treated by radium or radium and x-ray can be predicted by subtracting 10 per cent of the total number for the third year, 10 per cent for the fourth year, and 5 per cent for the fifth year, and results up to the eighth year by subtracting 2 per cent for each of the next 3 years. This should be of great value. Thus if at the end of the second year in a group of 100 patients 54 per cent are alive, 10 per cent may be subtracted for each of the next 2 years, leaving 34 per cent, and for the fifth year 5 per cent, leaving 29 per cent of predicted 5 year survivors. Thus final results will be within a 5 per cent error. Such mathematical maneuvers are of enormous value for the therapeutist can satisfy himself of his expected results after a follow-up of 2 years,

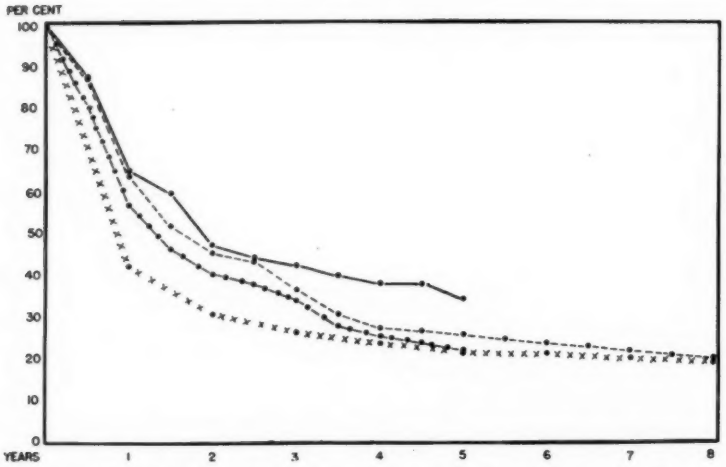

Chart 3. This chart shows that 2 years after treatment there is a very slow decrease, 10 per cent or less from the second to the third year, 10 per cent from the third to the fourth year, and 5 per cent from the fourth to the fifth year. After that not more than a 2 per cent fall occurs. There is no sudden drop and the fall is not more than the life expectancy for the given age groups. In the first and second years most of the deaths occur. This is probably due to the extent of the disease and not to the type of radiation. ——•—— Pondville, 70 cases; •-•-•-• M. G. H. radium, 150 cases; - - - - - M. G. H., 100 cases; x x x x x Radiumhemmet, 674 cases (1923–1927).

and certainly after a follow-up of 3 years. It is obvious that most of the deaths occur in the first 2 years and we are now coming to believe that most patients who have no obvious disease at the end of 2 years have a good chance for recovery.

What is the importance of these observations? That it is only necessary to follow our cases for 3 years following treatment and then by deducting 15 per cent, the 5 year end-results can be predicted. Therefore, it is unnecessary to wait for 5 years following treatment before reporting a group of cases or to change a method of treatment. In each radiotherapist's life, if he waits 5 years before making a report or changing a plan of treatment, there will be few opportunities to study a new series because it takes 2 years or more to obtain a large enough series of cases to report. Then by waiting 5 years for the end-results makes about 7 years in all. Thus in 28 years 4 series followed for 5 years could be reported and only 4 changes of treatment based on accurate figures could be made. By being able to predict the end-result at the end of 3 years from the time of treatment it will be possible to attempt more methods of management of cancer of the cervix based on satisfactorily followed-up cases. We feel that the observations from this study may make a great deal of difference in future reports of the results of treatment of cancer of the cervix.

Chart 5 is also of importance. In our previous paper we compared the total number of surgical cases directly with the total number of radiated cases at Pondville and the Massachusetts General Hospital and the comparison was not in favor of radiation but more in favor of surgery. This comparison was not fair for the surgical cases were those that could be operated upon, or in whom an attempt was made to operate. In other words, they were the operable or early cases. In this present study the surgical cases were carefully sorted out and all cases with broad ligament extension discarded so as to place the surgical cases in the A and B groups of the American College of Surgeons, comparable to the A and B groups who were treated with

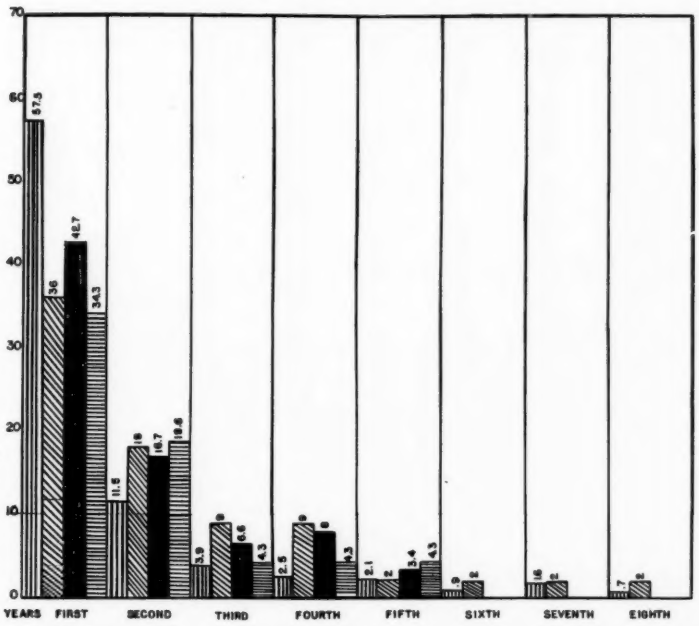

Chart 4. This chart shows by another method the percentage of deaths of the total number of cases for each year. Notice that not over 10 per cent die in the third and fourth years, while in the fifth only 5 per cent succumb, and in the remaining years not over 2 per cent per year. Vertical lines, Radiumhemmet, 674 cases; oblique, M. G. H., 100; solid black, M. G. H. radium, 150; horizontal, Pondville, 70.

radium. The results are plotted on a chart for 5 years and it is evident that surgical cases do not do as well as the radiated ones. In the Pondville series of 8 cases, a very sharp drop in the curve occurs between the fourth and the fifth years, one patient dying in that time. In the Massachusetts General Hospital's radiated cases a very slow fall occurs, 64.2 per cent of the cases in that series living at the end of 5 years. The Massachusetts General Hospital's surgical group, operated upon by Dr. Lincoln Davis and Dr. Farrar Cobb and reported some years ago, shows that there are but 47 per cent alive and well at the end of 5 years. These groups are as comparable as they can be made. This observation answers for us the question of whether or not we ought to operate upon cancers of the cervix. Until we can be sure that the curve of patients operated upon is the same or better than that of the patients treated with radiation we will not feel inclined to operate upon them. The operations done by Dr. Cobb and Dr. Davis were radical operations, not true Wertheim operations, but a modified Wertheim, a great deal more extensive than hysterectomies that one sees performed in this country today. We believe that they were more radical than most modern operators and that their patients died faster than did the patients given radiation, even excluding the surgical deaths.

PATHOLOGY

It was the plan of Meigs and Dresser that all Pondville patients have biopsies taken from the cervix throughout the treatment. A biopsy is taken before x-ray treatment is started, 1 at the conclusion of the x-ray treatment at the time of the first radium treatment, 1 at the time of the second radium treatment, and 1 before discharge from the hospital. In most cases we have 4 biopsies

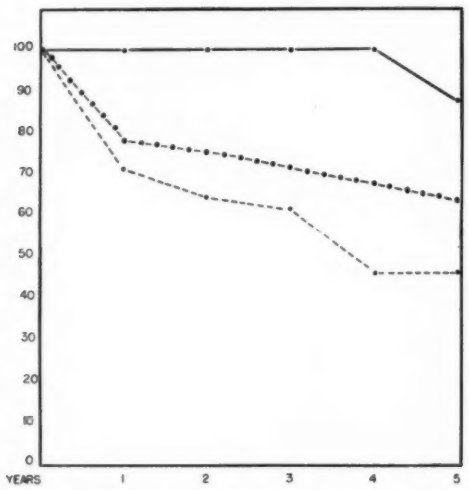

Chart 5. This chart graphically demonstrates that the fall of cases in comparable groups, A and B, is greater in the group operated upon than in the group treated with radiation. This chart is important to consider before deciding that surgery is better in early cases. A and B cases only. - - - - - M. G. H. surgical, 39 cases; •-•-•-• M. G. H. radium, 28 cases; ——•—— Pondville, 8 cases.

from the cervical tumor, and from the microscopical study of this material important conclusions have been drawn. It is our policy in the Out-Patient Follow-up Clinic to have all slides of the biopsies of each patient looked at when the patient is examined. It is the opinion of the authors that if a satisfactory radiation response or reaction is found microscopically in a case not too far advanced that a fairly good prognosis can be given the patient. If the reaction is not satisfactory and if at the end of the radium treatment uninjured or unchanged cancer tissue is still seen, it is felt that the prognosis is poor.

The microscopical slides of these cases have been studied recently by both the authors and by Dr. Shields Warren and Dr. A. O. Severance of the Department of Pathology at the Pondville Hospital. Detailed findings will be presented in a succeeding paper but a few of them are pertinent at present. It is well to state at the beginning that in the review of all the slides in this series the pathologists described radiation reaction microscopically in 2 cases before the patient had had any treatment; therefore, the microscopical diagnosis of radiation reaction, as evidenced by vacuolization of cells, prominence of the cell membrane, pyknosis of nuclei, abnormal mitotic figures, abnormal nuclei, fibrosis, change in blood vessel walls, and change in connective tissue stroma, is not 100 per cent accurate. Of 10 patients showing no radiation reaction in the epithelial portion of the tumor after x-ray treatment was completed, only 1, or 10 per cent, is living. Of 5 of the same 10 patients still showing no radiation reaction after both the x-ray and radium were given none are living. Of 12 showing no radiation reaction in the stroma after x-ray treatment, only 2, or 16 per cent, are living; and of 7 of the above 12 patients showing no radiation reaction in the stroma after both x-ray and radium none are living. Six patients with no reaction in either stroma or epithelium are dead. This finding is extremely important and bears out the observations made from the slides in the Follow-up Clinic. If radiation reaction is present and persists through the various biopsies, a fairly good prognosis can be hoped for. If no reaction is present, or if there is actively growing cancer without reaction anywhere on the slides, the outlook is poor. The results show that no radiation reaction after x-ray alone means a poor prognosis, whether the reaction is judged by the epithelial part of the tumor or the stroma. Those showing no effect on the tumor after radium was given are all dead.

The cases were divided into the following grades: there was 1 grade I or slowly growing type of cancer. This patient was in class C or the advanced group, and she is dead. Twenty-five, or 35.7 per cent, of the patients were classed as grade II or the medium grade tumor. Four of these 25 patients, or 16 per cent, were in the favorable group, classes A and B, and all are well. Twenty-one, or 84 per cent, were in classes C and D, the most unfavorable groups, and 7 of the 21, or 33 per cent, are living and well. Thirty-two, or 45.7 per cent, were grade III, or the rapidly growing type. Only 2, or 6.2 per cent, of these 32 cases fell into the early or favorable class; 1 is dead and 1 is living and well. Thirty of the 32 patients in the grade III

group, or 93.8 per cent, were in the C and D or unfavorable class; 8 of these 30, or 26.6 per cent, are living and well. There were 3 adenocarcinomas and 2 are well. One with carcinoma simplex is dead. The best results are in grade II, or those with medium grade malignancy, with 12 of 25 cases living and well in all groups.

METASTASES

In this series there were numerous metastases. One patient had metastases in the groin; this is a rather rare region to which malignant disease of the cervix will metastasize, but it is possible when the tumor is low in the vagina. One had metastases to the peritoneum, liver, and kidneys, and 2 metastasized to the lungs. There were patients who had metastatic cancer in the sacrum, coccyx, pelvis, ilium, ischium, and pubis. Four patients had extensive disease in the pelvis. The tumor apparently extended directly from the cervix or the pericervical regions. This extension may occur along the perineural lymphatics, as Warren, Harris, and Graves showed that it does in carcinoma of the prostate. It is possible that further autopsy studies will show that carcinoma of the cervix extends into bone exactly as prostatic cancer does.

OTHER FINDINGS

Weight loss seems to be important; of 26 patients with a definite loss only 6 are living and 20 are dead. Of 15 patients with severe pain at the time of the radiation treatment 3 are living and 12 are dead. Twenty-seven had reached the menopause; 11 of these patients are living and 16 are dead. Fifty-seven had regular menstrual periods, 21 of whom are living and 36 are dead, a figure of very little consequence. There were 21 patients with a family history of cancer; of these 4 are living and 8 are dead. Nine patients, or 12 per cent, had no children. This figure is about the same in all statistics, that is, about 10 to 15 per cent of patients have not had cervical lacerations or pregnancy hormone changes. Five patients had positive Wassermann reactions; 4 are living and 1 is dead. Routine Wassermann tests were done in all cases. A positive Wassermann is of little significance.

One of the most important findings in this series is the significance of the first examination 3 months after the patient's discharge from the hospital. If tumor was present, the prognosis was poor. In this series 36 patients showed disease at the first examination and of this group only 3 are living and 33 are dead. This again suggests that patients with cancer of the cervix die soon following treatment, also that if the first radiation does not check the growth there is very little hope that further treatment will do so. Therefore, we believe that the first examination is extremely important and is of great prognostic significance. If cancer is present, the patient will not recover; and if there is no cancer, recovery can be expected.

The tolerance to treatment and the general response of the patients have no prognostic significance, but local response of the tumor as far as the change in gross appearance is concerned is important. The local response was poor in 21 patients and only 1 is living and 20 are dead. But when the local response was good, as it was in 29 patients, 20 lived and only 9 died.

RENAL LESIONS

One of the most important findings made during this study is to be reported in detail later by Dr. Jaffe, Dr. Meigs, Dr. Graves, and Dr. Kickham. It is a report concerning the renal and ureteral lesions following and during treatment of cancer of the cervix. It is our opinion that by more intelligent management of ureteral obstruction, hydronephrosis, etc., we may be able to produce better end-results from the radiation treatment of cervical cancer than we have at the present time. We feel sure that many patients died unnecessarily from renal infections and uremia, who did not die because the growing tumor shut off the ureters but rather because changes in the tumor due to radiation or fibrosis of the pelvic connective tissue shut off the ureters and produced mortal lesions in the kidneys. It is our plan to consider and study the renal condition in more detail than ever before, to investigate the patients before they are given any radiation, during radiation, during the radium treatment, and before and after dis-

charge from the hospital. Thus we hope to find early lesions and treat them properly either by dilatation of the ureter or by nephrostomy. There is no doubt that most cases of cancer of the cervix die of uremia. In this series 25 of the patients had proven ureteral obstruction, and of that group all but 2 are dead and these 2 had intelligent urological treatment. Not all the patients had carcinoma blocking the ureters because some autopsies showed fibrosis around the ureter rather than gross cancer. Unfortunately, most ureters were not examined microscopically to rule out tumor but gross tumor was not present. It is probable that our treatment is producing changes in the pelvic connective tissue that may interfere with the ureter. It has been the contention of one of us (J.V.M.) that some of the swollen legs seen following treatment 1 to 5 years later are not due to advanced disease but to pelvic fibrosis with involvement of lymphatics and veins. It has been our experience to subject to radiation patients with swollen legs because malignant infiltration was considered the cause. It is quite possible that the swollen leg is due to fibrosis in the pelvis which shuts down the return supply of lymph and venous blood. At some time in the patient's life following treatment, perhaps during some illness or some infection when it is necessary to take to bed, the slowed up blood stream allows thrombosis to occur and phlebitis and edema follow. Further investigation is now being carried out along these lines. By watching our patients more carefully and by obtaining more material from autopsies we may be able to discover, as far as the genito-urinary tract and pelvis are concerned, whether our radiation treatment as given now is causing too much fibrosis.

SUMMARY AND CONCLUSIONS

This paper presents 70 patients who have been followed and studied very carefully. It shows that the results of the treatment of cancer of the cervix with x-ray and radium are eminently satisfactory. It is evident that certain charts of prognostic value can be made and the curves induce the authors to believe that it is no longer necessary to follow patients for 5 years before reporting on them but that a 3 year follow-up from the time of treatment should suffice. If, from the end-results at 3 years, 15 per cent is deducted for the next 2 years the approximate 5 year results can be predicted. Therefore, more opportunities are given to the gynecologist and radiologist to change a given form of treatment.

We believe that the routine study of microscopical slides, while the patient is being seen, is of great value. The presence or absence of a proper microscopical radiation reaction is an important prognostic sign. The authors advise that in every cancer clinic the slides be looked at at the same time that the patients are examined.

Biopsies should be taken before treatment starts and after treatment to determine whether or not radiation is satisfactory as determined by the radiation reaction.

In this series of cases it is evident that kidney lesions due to blocked ureters with subsequent uremia are among the chief causes of death. It is the feeling of the Pondville Staff that more urological investigation should be undertaken and it should be undertaken before, during, and following treatment. Any indication of ureteral block should be treated early rather than late.

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PATHOLOGICAL FEATURES OF SOFT TISSUE FIBROSARCOMA

With Special Reference to the Grading of Its Malignancy

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IN a recent publication (Meyerding, Broders, and Hargrave), we discussed the general etiological factors, clinical features, prognosis, and treatment of fibrosarcomas of the soft tissues of the extremities on the basis of a study of tumors from 152 patients. It is the object of this paper to present in greater detail their pathological features and to describe from a histopathological standpoint the different types of fibrosarcoma with special reference to the grading of their malignancy.

NOMENCLATURE

The gross and microscopic structures of fibrosarcomas recall the older terminology. These growths comprise the "fibroplastic tumors" of Lebert and Birkett, the "recurrent fibroids" of Paget, the "fasciculated sarcomas" of Cornil and Ranvier and the "fibronucleated tumors" of Bennett. Lancereaux, Billroth, and Virchow employed the terms "spindle-cell sarcoma" or "fibrosarcoma." The terms "neurogenic sarcoma," "neurosarcoma" and "neurofibrosarcoma" have been widely used to designate not only certain tumors showing definite nerve connections but also tumors of a similar architecture in which a nerve genesis has been presumed (Ewing, 24, 25; Bick, 4–6; Geschickter, 31; Fox, Simmons). Recently there has been a tendency for certain authors to assign as neurogenic practically all tumors which previously had been called fibrosarcoma and spindle-cell sarcoma (Quick and Cutler, Stewart and Copeland, Hertzler, Ryan and Camero). Less than a third of the patients, however, present significant nerve symptoms, characterized by radiating pain, paresthesia or paralysis, and in only about 10 to 15 per cent of the total number can definite nerve connections be demonstrated. In somewhat over half of these tumors the structure is that of a compact cellular spindle-cell sarcoma and is identical with the structure of many sarcomas which develop within nerve trunks and in the tumors of von Recklinghausen's disease. It is debatable, however, whether this structure is specific for nerve tumors, for many growths of exactly the same architecture neither produce pain nor show nerve connections. We, therefore, do not employ the neurogenic terminology here but designate all the tumors as fibrosarcoma.

In a subsequent paper we propose to discuss the genesis of these tumors.

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TOPOGRAPHIC DISTRIBUTION

Of 148 primary, solitary fibrosarcomas, 51 occurred in the upper and 97 in the lower extremities. In 4 patients the tumors were multiple. Three of these presented tumors in both the upper and lower extremities, while 1 exhibited tumors in both lower extremities. The flexor portions of both the upper and lower extremities were much more frequently involved than the extensor. Of the total number of tumors 43.4 per cent were situated in the region of the thigh and knee.

There were 102 male and 50 female patients. The average age at the time of registration at The Mayo Clinic, for the entire group, was 43.21 years.

GROSS ANATOMICAL FEATURES

Fibrosarcomas begin in their earliest recognizable form as small, hard, circumscribed,

movable tumors beneath the skin. Occasionally, those arising in the deeper structures may attain considerable dimensions before their presence is noticed. In certain tumors which develop after trauma, the post-traumatic edema may coincide with the swelling produced by the growing tumor and mask the true nature of the process. In 9 instances the sarcoma became manifest as a result of active growth of an apparently benign nodule of many years' duration.

In 62 of the 152 patients the tumors arose in the subcutaneous fat and loose fibrous tissue. In 3 patients the tumors apparently originated in the deep layers of the skin. In the remainder the tumors developed in the deep tissues, either in the loose intermuscular fat and fibrous tissue along the course of important vessels and nerves or in such positions as to be intimately associated with the deep fasciæ, intermuscular septa, muscles, muscle sheaths, or parosteal areolar tissue. In 16 patients the tumors were attached to important nerves or their sheaths. Of these, the brachial plexus was involved four times, the ulnar once, the median twice, the sciatic four times, one or both popliteals four times, and the femoral cutaneous once. One patient presented an intraneural tumor of the external popliteal. In 5 additional instances the tumors were in close proximity to important nerves and may or may not have been actually attached to them. These nerves were the ulnar, median, radial, internal popliteal, and peroneal.

Grossly, these tumors are rounded or lobulated and more than half are encapsulated. Those not encapsulated are usually exceedingly well circumscribed. In only 4 primary and 5 recurrent tumors did gross infiltration of the neighboring tissues occur. The capsule, in many cases, completely invests the growth and may be quite delicate or extremely thick and fibrous. In other instances the tumor may appear only partly encapsulated as the result of adhesion, usually in one, but occasionally in more than one place, to surrounding fasciæ or muscle bellies. The capsule is loosely attached to the surrounding soft parts but rather firmly united with the tumor by penetrating fasciculi of tumor tissue. These features account for the ease with which such sarcomas, in most instances, can be shelled out with their capsules from the neighboring structures. However, in unusual instances, the tumors may be so firmly united to the surrounding parts as to render their removal by excision technically impossible.

Their texture may be hard and fibrous, or soft and friable, depending on the amount of fibrous tissue which they contain. In accordance with this, the cut surface may exhibit bundles of fibrous tissue running in various planes, similar to those seen in certain fibromyomas, or may be extremely soft and homogeneous. All transitions are found between these two types. Gelatinous regions may be present in places, or to such an extent as to call for the designation of "myxosarcoma." Edema, as the result of venous occlusion or stasis, occasionally involves the tumor in foci or as a whole and may give rise to pseudomyxomatous changes (Coureaud, Dalger, and Séguy) similar to those observed in certain liposarcomas (Jaffé). In many so called myxosarcomas the texture is produced by simple edema, for positive reactions for mucus are not always obtained with thionine and mucicarmine.

Cystic areas are sometimes encountered, especially in very cellular spindle-cell tumors. These cysts may be large or small and frequently show delicate trabeculæ traversing their diameters. Necrosis from infarction, and areas of hemorrhage, both old and new, as a result of rupture of fragile vessels are frequently found in rapidly growing tumors. Areas of calcification, demonstrated roentgenologically or by the gross or microscopic examination of the tumors, were present in 11 cases. Ossification of the stroma of spindle-cell sarcomas has been described by Butlin, Hutchinson, and Jaidka, and it occurred in 2 of our cases (Fig. 1).

FEATURES OF TUMOR GROWTH AND METASTASES

The growth may be rapid or slow, depending on the cellular structure of the tumor. Even though frequently encapsulated, these tumors possess a remarkable capacity for invasion of the surrounding structures, which is brought about after penetration of their cap-

sules. Practically all tumors which attain sufficient size become densely adherent, in one or more places, to the surrounding fasciæ and muscle tissue. Occasionally they grow in such a way as to surround completely important vessels and nerves, incasing them within solid tumor masses, and they may produce marked swelling and induration of the parts as a result of venous occlusion. Periosteal reaction with erosion of the bone cortex may result from irritation of the tumor, while occasionally bone atrophy occurs from pressure. These features were demonstrated in 9 instances. Actual bone invasion with destruction of the cortex and medulla was present in 19 cases (Fig. 2). Occasionally, rapidly growing tumors protrude through the sites of operative incisions, producing large infected mushroom-like growths. Tumor fungi may likewise result after destruction of the skin with cancer pastes or may, in unusual instances, occur spontaneously.

Following simple excision, the tumors practically always recur. Recurrent tumors may be either single or multiple and are usually located in the region of the previous operative incision. They, like the primary growths, are nearly always encapsulated or sharply delimited, except at points of adherence to the neighboring soft parts. Following amputation, stump involvement frequently occurs. We have found little to support the view, presented by Stewart and Copeland, that stump recurrences represent new, primary tumors developing higher up along the nerve trunks.

After repeated recurrences the patients die of visceral metastases or from sepsis or hemorrhage as a result of ulcerating tumors. Pulmonary metastasis is by far the most frequent cause of death and of 104 patients who died as the result of the sarcoma 60 are known to have developed pulmonary involvement. In all probability many other patients developed this condition but our knowledge does not permit definite conclusions to be made on this point. Regional lymph nodes were involved in 5 patients, in 2 of whom the primary tumor was in the upper and in 3 in the lower extremity. Intra-abdominal and hepatic metastases were present in 15 cases, in 13 of which the primary tumor was in the lower extremity. In 9 cases the sarcoma terminated the life of the patient by widespread visceral, cutaneous, and osseous metastases.

The duration of the disease in fatal cases varies considerably and depends on the type, degree of malignancy, and location of the tumor, the natural resistance and age of the patient, and the diligence with which treatment is instituted. Rapidly growing and metastasizing tumors may prove fatal within 6 to 8 months after their apparent onset, while in protracted cases the patients may succumb to the sarcoma as long as 20 or more years after its manifestation. One patient in the present series, whose case has been previously reported by one of us (Meyerding, 44), died from pulmonary metastasis 22 years after the onset of the disease and after an 11 year clinical cure following amputation, while another patient died from pulmonary metastasis 23 years and 3 months after the onset of the tumor and 3 months after excision of the eighth local recurrence.

MICROSCOPIC STRUCTURE AND HISTOLOGIC TYPES

These tumors are composed of fibers and cells built on a scaffolding of minute blood vessels. The system of growth varies considerably in different tumors. Some present a fasciculated pattern produced by bands of parallel fibers and cells traversing various planes, while others display an intertwining arrangement of the component parts.

The periphery of the growth is usually sharply demarcated and the capsule, if present, comprises a tunic of connective tissue closely applied to the tumor cells. The capsule shows numerous points of penetration by fasciculi of tumor cells growing out obliquely. In tumors that infiltrate the surrounding tissues, the advancing margin of the process is frequently preceded by a protective barrier of fibrous tissue, the older parts of which become absorbed in the recently formed neoplastic tissue as the growth progresses.

Incorporated muscle, blood vessels, and nerves may be found within the tumor. In cases of muscle invasion an inflammatory reaction usually precedes the advancing

growth. Actual invasion is accompanied by fragmentation and atrophy of the muscle fibers and is occasionally associated with a multiplication of the muscle nuclei. No evidence was found to substantiate the view presented by Sokolow, Fujinami (29), and Leadingham that the muscle elements are sometimes actually transformed into sarcoma cells.

The supporting stroma is composed of delicate fibers radiating from small vessels, many of which are extremely fragile and composed of a single layer of endothelium. Frequently tumor cells come directly in contact with the blood current and occasionally they line vascular spaces for a considerable distance. On a few occasions we have observed tumor thrombi within the intrasarcomatous and capsular vessels. These features afford ample opportunity for malignant elements to be swept into the circulation and explain the frequency of pulmonary metastasis. The freedom from involvement of the lymph nodes, although by no means universal, is due both to the absence or scarcity of lymphatics within the tumor and to the infrequency of secondary lymph vessel invasion, determined by the expansive rather than infiltrative nature of the growth process and the protection afforded by the enveloping capsule.

The cellular elements resemble fusiform fibroblasts and may consist of either large or small cells intermingled or in almost pure form. For the most part three rather distinct varieties may be distinguished, namely: fibrogenic sarcoma, cellular spindle-cell sarcoma, and myxosarcoma. Table I shows the anatomical distribution of these tumors.

The structure of fibrogenic sarcoma is rather specific. The individual cellular elements are fusiform, may vary considerably in size, are not closely packed, and are separated by strands or bundles of collagen fibrils. All gradations are found between very fibrous growths, which closely approach benign fibromas, and highly malignant tumors. In the fibrous tumors of low malignancy (Figs. 3 and 4) the cellular elements closely resemble fibroblasts and show a moderate degree of variation in size and form. The nuclei are oval and may be slightly lobulated or spindle-shaped. The nuclear chromatin forms a rather delicate reticular network, the whole structure appearing usually not very chromatic. One or more prominent basophilic or achromatic nucleoli are frequently present. The cytoplasm is abundant, acidophilic, and drawn out into long processes at the ends of the cells. In this type of tumor cellular division occurs by mitosis and is not very prolific. As the tumor ascends in the scale of malignancy (Figs. 5, 6, and 7), many of the cells take on unusual growth capacities, so that very large and much smaller cells are present in the same tumor. Both the cytoplasmic and nuclear volumes are increased. There is a definite increase in the amount of nuclear chromatin and multiple large granules may be present. Large, long, spindle cells with abundant acidophilic cytoplasm appear. Gigantic cells with lobulated and multiple nuclei may be produced as a result of nuclear budding. Atypical and multiple mitoses are frequent. The cytoplasm of some of the cells may show vacuolization or albuminoid granules as a result of degeneration. Scattered about are smaller spindle cells of various sizes with small amounts of cytoplasm and oval or spindle-shaped, dark staining nuclei, similar to those seen in cellular spindle-cell sarcoma. Everywhere the cells are separated by delicate strands of collagenous fibrils. In some of the more malignant tumors the amount of collagen may be considerably reduced, yet the fibrogenic capacity of the tumor is retained. In this particular type of sarcoma the fibroblasts seem to be stimulated along greatly exaggerated normal lines of growth and function.

In cellular spindle-cell tumors the individual elements more nearly approach a uniform size and are densely packed. There is little intercellular substance (Figs. 8, 9, and 10). The cells in different tumors vary in size and shape but those in a given growth, except for slight variations, usually appear quite identical. The cells may be smaller, about the same size, or considerably larger than those seen in the fibrogenic tumors of low malignancy. They are spindle-shaped and the cytoplasm, which is extremely scanty, is drawn out into delicate end processes along the long axis of the cell. The nuclei are

plump or slender, and fusiform, and usually show pointed but sometimes blunt ends. The chromatin granules are coarse, the nuclei appearing compact and much more chromatic than those of fibrogenic sarcoma. One or more minute basophilic nucleoli may or may not be present. Nucleoli are practically never prominent features in this particular type of tumor. Cellular division occurs indirectly and is uniform. Large cells and tumor giant cells are never conspicuous features. The cells are separated by a network of reticulin fibers which make up the loose intercellular substance. Some tumors show practically no collagen fibrils except the supporting stroma of blood vessels, while in other instances a few intercellular collagen fibrils are present. The more malignant fibrogenic tumors appear much more formidable under the microscope than do spindle-cell growths of an equal degree of malignancy.

Transition forms between cellular spindle-cell tumors and certain fibrogenic tumors are occasionally found. These are composed of long spindle-shaped cells or what, with ordinary stains, appear to be branching cells arranged loosely in interlacing fasciculi. The nuclei resemble those seen in cellular spindle-cell tumors. The cellular elements are separated by microcystic spaces and by fine reticulin fibers and perhaps a few wavy collagenous fibrils (Fig. 11). In other tumors of the same type, collagen production is well developed producing a form of low grade fibrogenic sarcoma. Tumors of this series comprise the so called neurogenic sarcomas.

Whether genuine myxosarcoma is a variant of fibrosarcoma is uncertain. Many myxosarcomas can be more closely traced to fat cells, for all variations are found between liposarcoma and pure myxosarcoma (Ewing). Many cellular spindle-cell tumors show areas of loose structure composed of stellate or spindle cells separated by a considerable quantity of myxomatous or pseudomyxomatous tissue (Fig. 12). A few fibrogenic tumors show similar features. There may be considerable variation between the structure of primary and recurrent fibrogenic or spindle-cell tumors in regard to the amount of myxomatous or pseudomyxomatous tissue present. The cytoplasm of the cells may be very scanty or quite visible and drawn out into one or several processes. In some myxosarcomas the nuclei closely approach those seen in small spindle-cell sarcoma, while in other instances the nuclei are more vesicular, oval or lobulated, are not very chromatic, and resemble the nuclei in fibrogenic tumors (Fig. 13).

Speculations as to the nature of myxosarcomas, although interesting, are not very practical. The practical aspect of the subject, we have shown, is in regard to their degree of malignancy. Their malignancy may be accurately determined by the rules set down for fibrogenic sarcoma.

A small but not well defined group of tumors have certain distinguishing features both clinically and microscopically. These tumors are highly malignant, run a very rapid course, and prove fatal early. Grossly, they are soft in texture and often show areas of necrosis. Their structure is very cellular and composed of plump, spindle-shaped, or polyhedral cells, often with abundant acidophilic cytoplasm and very little intercellular substance (Fig. 14). There is usually only slight variation in the individual cellular elements; however, tumor giant cells may be quite numerous. The nuclei are very hyperchromatic and prominent nucleoli may be a conspicuous feature. Tumors of this nature probably represent highly malignant, undifferentiated fibrogenic or spindle-cell tumors. They, however, cannot with clarity be identified with either of these forms.

A peculiar morphological feature present in certain spindle-cell and anaplastic cellular tumors is a perivascular arrangement of the tumor cells. These tumors comprise the so called peritheliomas (Borrman, Zeit, Ewing), which derive their name from the probably hypothetic perithelium, a membrane, described by Eberth, ensheathing the small vessels of the pia mater, and later declared to be present about the blood vessels of the adrenal, pineal gland, breast, and salivary glands (Zeit).

The structure is typical and consists of medium sized arterioles surrounded by a heavy mantle of tumor cells, while the intervening parts are composed of loose myxoma-

tous tissue (Figs. 15 and 16). A secondary peritheliomatous picture may be the result of massive necrosis of all the cells except those immediately surrounding the blood vessels. Some carcinomas present a similar architecture; hence a peritheliomatous structure has no histogenetic significance. The particular pattern is apparently determined by the relatively large caliber of the supplying arterioles, the rapidly growing cells using them for a scaffolding and for nourishment. These peritheliomas, although closely related, are somewhat different in structure and can usually be distinguished from peritheliomatous angiosarcomas and endotheliomas.

There were 7 examples of perivascular fibrosarcoma among the cases studied, 3 of which were clearly the result of intervascular necrosis; 4 occurred in the thigh and 1 each in the buttock, elbow region, and forearm. All were highly malignant tumors and there was but one cure, the patient with the tumor of the forearm being well at the time of last report, 6 years and 7 months after amputation.

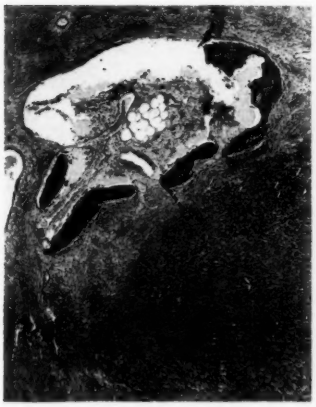
Of the 152 cases, 70 represent fibrogenic sarcoma, 57 spindle-cell sarcoma, 17 myxosarcoma or fibromyxosarcoma, and 8 cellular anaplastic sarcoma.

Recurrent tumors nearly always show the same structure as the primary growths and in persistently recurring tumors the structure and degree of malignancy are essentially the same for each recurrence. We have been unable to substantiate the view that with each recurrence the tumor is likely to become more and more malignant. The only appreciable variation seen in recurrences is in regard to the amount of myxomatous tissue present. A recurrent tumor may be more or less myxomatous than its predecessor, without showing any other alteration in its cellular structure. There is no evidence that a recurrent fibrogenic tumor may change its structure and become a compact spindle-cell tumor, and neither is there evidence that a change may occur in the opposite direction.

There are certain clinical as well as histological features which distinguish fibrogenic and cellular spindle-cell sarcomas. The average age of patients with fibrogenic sarcoma was 48.2 years as contrasted with an average age of 36.5 years for patients with spindle-cell tumors. The average age of the 17 patients with myxosarcoma was 49.4 years. Although extremely malignant, spindle-cell tumors, taken as a group, run a longer average duration before producing death than do fibrogenic tumors, the average duration of life from the onset of symptoms until death being 69.9 and 58.4 months, respectively. A more marked contrast is obtained if a comparison is made between the duration of spindle-cell and fibrogenic tumors of a comparable degree of malignancy, the average duration of life in fatal cases of the latter group (grade 3 and 4 tumors on a basis of 1 to 4) being only 39.7 months. An explanation of these observations is afforded by the fact that, although many patients with spindle-cell tumors die within 2 to 4 years from the onset of the disease, there are a considerable number of tumors which persistently recur for many years before causing death, while in other instances

TABLE I.—DISTRIBUTION OF DIFFERENT TYPES OF SARCOMA ACCORDING TO LOCATION AND TO SEX OF PATIENT

Location	Fibrogenic sarcoma and myxosarcoma		Spindle-cell and anaplastic sarcoma		Total
	Males	Females	Males	Females	
Upper extremity					
Shoulder	4	0	2	0	6
Arm	7	2	6	1	16
Elbow region	6	0	2	3	11
Forearm	6	2	2	4	14
Hand	2	0	1	1	4
Total	25	4	13	9	51
Per cent	49.02	7.84	25.49	17.65	100
Lower extremity					
Buttock	3	1	2	0	6
Thigh	14	15	17	2	48
Knee region and popliteal space	3	4	9	2	18
Leg	9	6	2	3	20
Foot	1	2	4	2	9
Total	30	28	34	9	101
Per cent	29.70	27.72	33.67	8.91	100
Grand total	55	32	47	18	152
Per cent	36.19	21.05	30.92	11.84	100



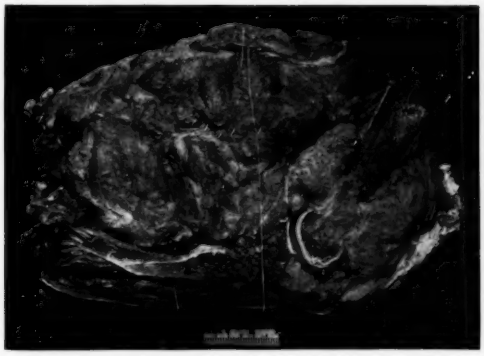


Fig. 1. Aberrant bone and bone marrow formation in a recurrent spindle-cell sarcoma of the popliteal space. ×30. Amputation was performed and there was no recurrence at time of death, 20 years, 3 months afterward. (Fig. 7, SURG., GYNEC. & OBST., 1936, 62: 1010–1019.)

Fig. 2. Grade 4 spindle-cell sarcoma with secondary involvement of the humerus, radius, ulna, and elbow joint; present in a woman aged 62 years. Amputation; death 4 months afterward from recurrence in stump and generalized metastasis.

the patients die of late pulmonary metastases many years after the original tumors were clinically cured. In other words, spindle-cell tumors tend to keep on recurring until they finally kill the patient, even though it may take many years. Late recurrences are, on the other hand, less frequently seen in fibrogenic tumors and consequently the chances for cure are better than for spindle-cell tumors after a certain period of time has elapsed without recurrence.

Fibrogenic sarcomas and myxosarcomas, especially those of lower grades, are more often encapsulated than spindle-cell tumors. Of 73 encapsulated tumors, there were 48 (65.8 per cent) which fell under the fibrogenic and myxosarcomatous group. Non-encapsulated and infiltrating tumors were about equally divided between the two types, while ulceration occurred approximately twice as frequently in fibrogenic as it did in cellular spindle-cell sarcomas, 16 and 7 cases, respectively.

Of 21 tumors attached to or surrounding important nerves there were 9 fibrogenic sarcomas, 2 myxosarcomas, and 10 spindle-cell sarcomas. In 10 instances in which large vessels were adherent to or surrounded by the tumor, there were 6 fibrogenic sarcomas, 1 myxosarcoma, and 3 cellular spindle-cell sarcomas.

Secondary muscle invasion occurred in approximately the same proportion as the incidence of the 2 groups; 24 fibrogenic and 17 spindle-cell sarcomas.

The anatomical location had no relation to the type or grade of the tumor (Table I), except that sarcomas of muscle and muscle sheaths were usually of the fibrogenic type (14 fibrogenic and 5 spindle-cell tumors).

MICROSCOPIC DIAGNOSIS

The microscopic diagnosis of fibrosarcoma is usually clear and is established by the characteristic structure and the presence of dividing cells. However, in many slowly growing cellular, spindle-cell sarcomas, the degree of malignancy may be considerably underestimated, particularly if the number of mitotic figures alone is taken into consideration. Every very cellular "fibroma" should be looked on with suspicion and widely excised (Bloodgood).

Reparative and inflammatory reactions occasionally show mitosis of fibroblasts but they are generally easily distinguished from

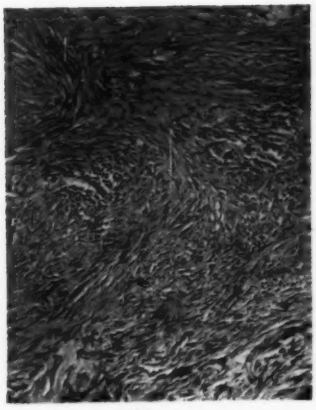


Fig. 3.

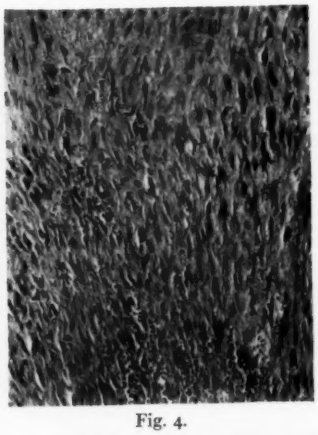


Fig. 4.

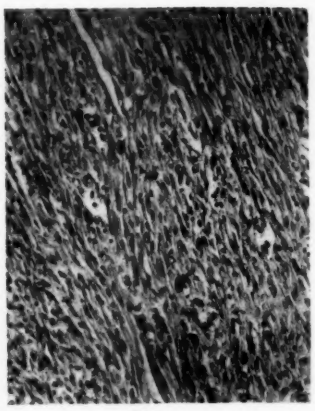


Fig. 5.

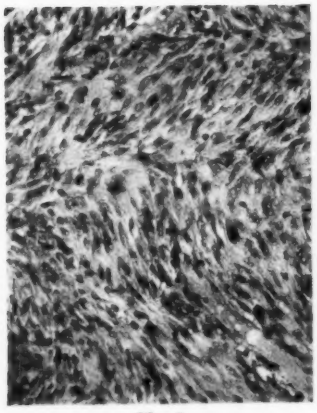
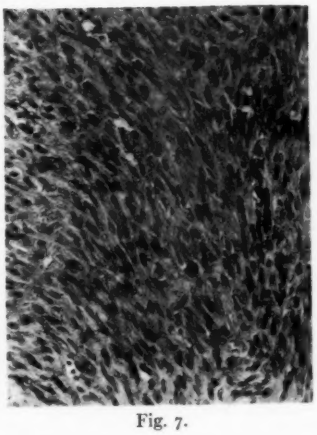


Fig. 6.



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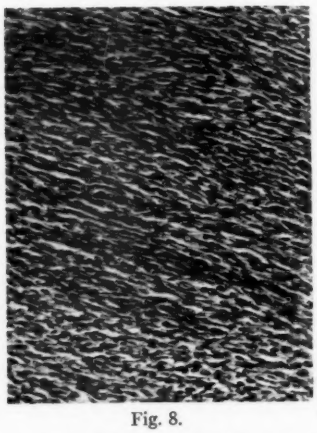

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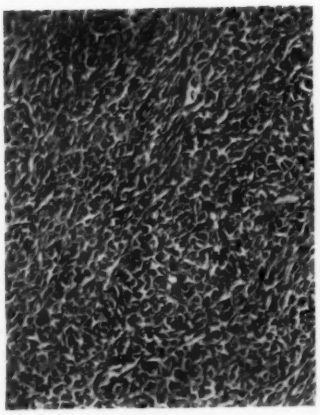

Fig. 9.

Fig. 10.

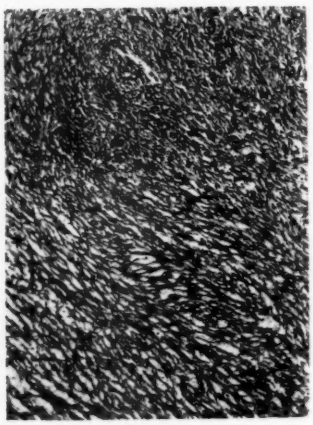

Fig. 11.

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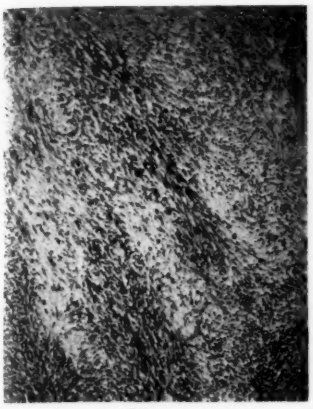

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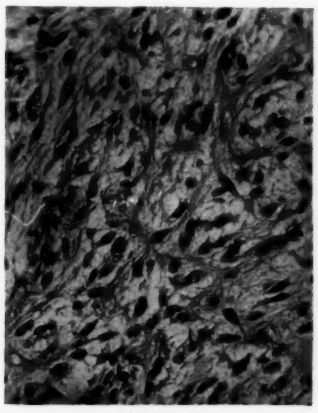

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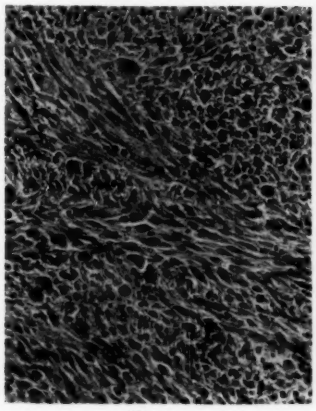

Fig. 14.

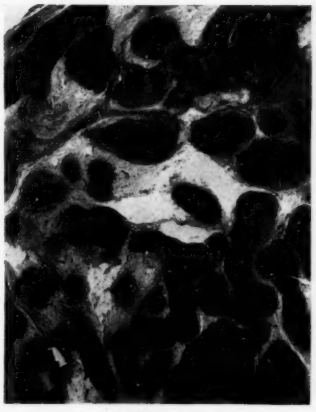

Fig. 15.

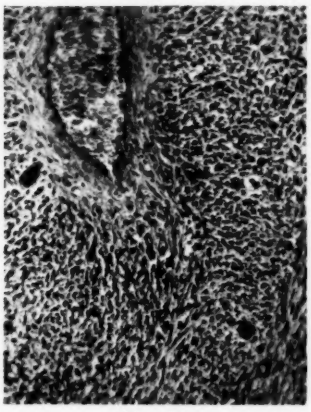

Fig. 16.

Fig. 3. Grade 1 fibrogenic sarcoma. ×110. This was a small encapsulated tumor of the thenar eminence. Local excision followed by radium therapy. No recurrence at end of 6 years. (Fig. 4a, SURG., GYNEC. & OBST., 1936, 62: 1010–1019.)

Fig. 4. Grade 1 fibrogenic sarcoma from the plantar surface of the foot showing marked collagen production. There were similar tumors involving the plantar surface of the other foot and left arm. ×128

Fig. 5. Recurrent, grade 2 fibrogenic sarcoma of the leg in a woman aged 49 years. Treatment consisted of wide local excision and extensive roentgen therapy. There had been no recurrence at time of last report, 9 years, 4 months afterward. ×128

Fig. 6. Grade 3 fibrogenic sarcoma, primary in the thigh of a 54 year old man. Marked variation in size of nuclei; many mitotic figures and moderate fibrogenesis. Patient died of pulmonary metastasis, following multiple local excisions and amputation. ×128

Fig. 7. Grade 4 fibrogenic sarcoma showing numerous mitotic figures. Section from a large tumor originating in the soft tissues over the right scapula in a 62 year old man. ×128

Fig. 8. Grade 4 spindle-cell sarcoma showing closely packed hyperchromatic nuclei of almost identical size and a few collagen fibrils. Tumor of the popliteal space surrounding the popliteal vessels and nerves in a 23 year old man. ×128

Fig. 9. Grade 4 spindle-cell sarcoma involving the sciatic nerve in a 36 year old man. ×128

Fig. 10. Same tumor as shown in Figures 2 and 12. Rapidly growing spindle-cell structure, intercellular reticulin and few collagen fibrils. ×158

Fig. 11. Transition form between cellular spindle-cell tumors and certain fibrogenic tumors. Loosely arranged spindle cells separated by reticulin. Grade 2 fibrocellular sarcoma of the left forearm in a 67 year old man. Before the appearance of this tumor, a similar but more fibrous sarcoma had been removed from the left thigh. Later, multiple subcutaneous and visceral tumors developed producing death. The patient had no clinical evidence of von Recklinghausen's disease. ×48

Fig. 12. Same tumor as shown in Figure 2. Spindle-cell structure showing edematous changes. ×46

Fig. 13. Grade 2 fibromyxosarcoma. Very large encapsulated tumor of the thigh involving the quadriceps muscle. Death 1 year after excision probably from intra-abdominal metastasis. (Fig. 4b, SURG., GYNEC. & OBST., 1936, 62: 1010–1019.) ×60

Fig. 14. Grade 4 anaplastic sarcoma with marked variation in cell size and non-collagenous intercellular substance. This tumor originated in the subcutaneous tissues of the thigh of a 69 year old man. ×130

Fig. 15. Topography of perithelioma. Grade 4 perivascular spindle-cell sarcoma. Third recurrence of tumor of buttock in a 25 year old man. Death from recurrence and metastasis to lungs and ribs. ×6.7

Fig. 16. Structure of tumor shown in Figure 15. Highly malignant hyperchromatic cells radiating from an arteriole. (Fig. 5, SURG., GYNEC. & OBST., 1936, 62: 1010–1019.) ×91

sarcoma. The presence of pathological mitosis is of little practical value in the diagnosis of malignancy of connective tissue tumors, for, when it does occur, it is usually in an obviously highly malignant growth.

Tumors most often confused with fibrosarcoma are angio-endothelioma and rhabdomyosarcoma. Many so called angiosarcomas and endotheliomas present a structure very similar to small spindle-cell sarcoma. However, the presence in foci of an alveolar arrangement of the cells or the complete or abortive formation of numerous small vessels is strongly suggestive of a vascular origin. Endotheliomas can usually, but not always, be distinguished by the nearly exact uniformness in the size of the cells, plump oval or rounded nuclei, and the absence of intercellular substance. The presence of prominent nucleoli in small oval and spindle-cell tumors may be of diagnostic aid, for nucleoli are usually not prominent in spindle-cell sarcomas but are frequently conspicuous in soft tissue endotheliomas. Notwithstanding these histological differences it may be impossible to determine the exact genesis of certain tumors.

A group of highly malignant sarcomas present as a characteristic feature, numerous very large, polymorphous, tumor giant cells having a violaceous staining granular cytoplasm with round, oval or irregularly shaped nuclei of various sizes. Frequently the cells assume an elongated spindle form and occasionally they present longitudinal fibrils which are sometimes cross striated. At other times a distinctly foamy appearance of the cytoplasm recalls the structure of congenital rhabdomyoma of the heart. Often there is little intercellular substance; again there are many collagen fibrils, while a myxomatous groundwork is sometimes present. Areas in certain tumors may exactly simulate fibrogenic sarcoma. There is considerable evidence that these particular tumors represent rhabdomyosarcomas originating from skeletal muscle. Montpellier collected from the literature 12 cases of authentic rhabdomyosarcomas of the extremities (Marchand, Nanotti, Genevet, 3 cases; Fujinami, (28); Burgess; Amunategui; Muller; Johan; Stulz, Diss and Fontaine; Abrikossoff). Three additional cases include those of Wolbach, (59, 60), Wagner, and Crossan. These tumors, however, are not as infrequent as the number of reported cases would indicate (16 of 232 soft tissue sarcomas reviewed in our study). Rakov has recently studied 17 muscle tumors, 15 of which he interpreted as rhabdomyoblastomas. Their occurrence is frequently masked under the diagnosis of giant-cell sarcoma, neurosarcoma, fibrosarcoma, or myxosarcoma. Differentiation from fibrosarcoma is, at times, made with difficulty. However, the characteristic foamy giant cells are strongly indicative of the true nature of the growth. Primary fibrosarcoma of muscle or secondary invasion of muscle by extramuscular sarcoma may now and then produce a picture similar to rhabdomyosarcoma, but these tumors can usually be distinguished.

MALIGNANCY INDEX OF FIBROSARCOMA

In this study we have more or less utilized the fundamental principle of cell differentiation in the grading of the sarcomas, a principle which was employed by one of us (Broders) in the grading of carcinomas (11–17).

Quick and Cutler divided soft tissue sarcomas into three grades to designate their relative malignancy. Acellular, fibrous growths composed of large spindle cells lying in a dense stroma of hyaline fibrous material were classed as grade 1 tumors. Cellular sarcomas composed of large spindle cells with very little intercellular substance were considered as grade 2 malignancies, while very cellular tumors composed of small spindle cells arranged in whorls and fasciculi or of polyhedral cells growing diffusely in a loose fibrillar network were defined as grade 3 malignancies.

Grynfeltt recognized fibrillar, afibrillar, and pseudofibrillar varieties. The fibrillar tumors contain collagen fibrils, which according to Grynfeltt are crystallized outside the cells in the colloidal intercellular gell. The afibrillar variety contains no collagen fibrils except in the stroma, while pseudofibrillar tumors are without fibers except in those portions adjacent to blood vessels. Grynfeltt expressed the opinion that afibrillar and pseudofibrillar growths are the more malignant. He had, however, too few cases to prove this point.

Stewart and Copeland, and French graded essentially according to the system of Quick and Cutler. Of 73 cases included in Stewart and Copeland's series, 16 were graded 1, 36 graded 2, and 21 graded 3. The prognosis was decidedly better in grade 1 than in grade 2 and 3 tumors (55).

Geschickter (32) made a sharp contrast between fibrospindle-cell sarcoma, which showed a histological composition of fibroblasts, spindle cells, or small oat cells, and neurogenic sarcoma. Geschickter found a good prognosis in the low grades of fibrospindle-cell sarcoma and a poor prognosis in the higher grades of malignant oat-cell sarcoma in the fibrospindle-cell series. Those tumors which he called neurogenic sarcomas were all extremely malignant.

In discussing sarcomas of the nerve sheaths Geschickter (32) stated: "Histologically there is a remarkable degree of uniformity in the majority of these tumors. They are composed of tightly interlacing strands of plump spindle cells which may occasionally be elongated with wavy fibrils and at other times show enlarged nuclei with mitotic figures and tumor giant cell formation. From this typical picture, which can be considered grade II or III sarcoma, the tumors vary on the one hand toward the benign myxoid neurinomas, merging imperceptibly with the histological forms of this benign group, which may be termed the grade I sarcomas, and on the other hand a group showing numerous tumor giant cells and epitheloid forms, representing grade IV in malignancy." Figure 32 of this publication by Geschickter is a reproduction of a photomicrograph of a very cellular compact, afibrogenic, small spindle-cell tumor which he called a grade 2 sarcoma of the nerve sheath.

In a later publication Geschickter and Lewis (33) divided fibrosarcoma (excluding their neurogenic variety) into differentiated and undifferentiated types. The differentiated sarcomas were composed of malignant fibroblasts and collagen, and graded into fibromas, while the undifferentiated tumors were composed of tightly packed cells with little intercellular substance.

Sections taken from different parts of a given fibrosarcomatous tumor nearly always show the same structure. Consequently any given section is usually representative of the nature of the bulk of the tumor. Considerable reliance can therefore be placed on microscopic sections, provided the tumor itself and not extraneous fibrous tissue is included. When there is much edema or myxomatous tissue, several sections from various parts of the tumor should be studied in order to include any very cellular areas, which, if present, are indicative of the true nature of the growth.

In order to arrive at definite criteria governing the grading of sarcoma, the tumors of the 152 cases were classified both according to the relative amounts of collagen fibrils and cellular elements and according to the number of mitotic figures and tumor giant cells which they presented.

At first the tumors were divided into four groups in relation to the number of mitotic figures and tumor giant cells. In group 1 were placed those tumors showing a minimum number of mitotic figures, in group 4 those with a maximum number of mitotic figures and tumor giant cells, and in groups 2 and 3 those tumors having an intermediate amount of these elements. Grading by this method was extremely unsatisfactory and unreliable.

The tumors were then grouped into 3 classes according to the relative proportion of fibers and cells so that the following types were distinguished: (1) fibrous tumors, (2) fibrocellular tumors, and (3) cellular afibrous tumors. The first group represented fibrogenic sarcoma, the second group, fibrogenic sarcoma, fibromyxosarcoma and myxosarcoma, and the third group, cellular spindle-cell and anaplastic cellular sarcoma. Table II shows the frequency of these tumors.

All cellular spindle-cell afibrogenic tumors are extremely malignant, irrespective of the number of mitotic figures which they exhibit. In 6 cases of cellular spindle-cell tumors showing a minimum number of mitotic figures there were no cures. Likewise, in 25 cases of the same type of tumor showing a moderate number of mitotic figures there were but 2 cures, while in 19 cases in which the tumors showed numerous mitotic figures there was 1 cure. Of 7 traced patients having cellular ana-

TABLE II.—TYPE AND GRADE INCIDENCE OF 152 CASES

Index of malignancy	Fibrous	Fibrocellular	Total	Per cent	Cellular	Total for all cases	Per cent of all cases
Grade 1	10	14	24	27.59		24	15.8
Grade 2	17	18	35	40.22		35	23.0
Grade 3	3	20	23	26.44		23	15.2
Grade 4	0	5	5	5.75	65	70	46.0
Total	30	57	87	100	65	152	
Per cent	34.48	65.52	100				
Per cent of all cases	19.74	37.50	57.24		42.76		100

plastic sarcomas, which were not typical spindle-cell tumors, there was 1 cure. Moreover, in cellular spindle-cell sarcoma there is no relation between the number of mitotic figures and the duration of the disease in fatal cases. The shortest survival period, however, is observed in anaplastic cellular sarcoma, where the average duration of life in 6 fatal cases was but 21 months.

On the other hand, the number of mitotic figures is an accurate guide in estimating the malignancy of fibrous and fibrocellular tumors. The relative malignancy, however, determined by the number of mitotic figures, decreases in inverse proportion to the number of fibers. Nevertheless, for practical purposes fibrous and fibrocellular tumors have been considered under one group, for, as the index of malignancy increases, more and more tumors fall under the fibrocellular group. Thus there were only 3 grade 3 and no grade 4 fibrogenic sarcomas which could be called fibrous (Table II).

The malignancy of fibromyxosarcoma is, likewise, directly proportional to the number of mitotic figures and tumor giant cells. Of 16 traced patients with myxosarcoma, there were 7 grade 1, 6 grade 2, and 3 grade 3 tumors. There were 4 cures among the tumors of grade 1, 2 among those of grade 2, and none among those of grade 3.

The duration of life in fatal cases of fibrogenic sarcoma and myxosarcoma is similarly inversely proportional to the grade of the tumor. In 12 grade 1 tumors the average duration of life from the onset of symptoms until death was 100.6 months; in 19 grade 2 tumors it was 51.4 months; in 15 grade 3 tumors it was 43.2 months; and in 5 grade 4 tumors it was 29.3 months.

If all cellular tumors are included under grade 4 and fibrous and fibrocellular tumors are combined, of 22 traced patients with tumors of grade 1, 45.5 per cent were cured; of 30 traced patients with tumors of grade 2, 36.7 per cent; of 18 traced patients with tumors of grade 3, 16.7 per cent and of 62 traced patients with tumors of grade 4, 6.5 per cent were cured. Of the 28 cures, 24 had persisted for over 5 years and 4 for 3 to 5 years at the time of last report.

For further details concerning treatment, final results and prognosis, reference is given to our previous publication (45).

SUMMARY

A synopsis of the pathological features of fibrosarcoma, based on a study of 152 cases, is presented. Fibrogenic and cellular spindle-cell sarcomas constitute, for the most part, two distinct clinical and pathological groups. Fibrogenic sarcomas and myxosarcomas usually occur in older patients than do spindle-cell tumors. The clinical course of spindle-cell sarcoma is often prolonged and the prognosis not good (7 per cent cures). The prognosis in cases of fibrogenic sarcoma and myxosarcoma is fairly good (32 per cent cures). Group prognosis can, with considerable accuracy, be determined by the microscopic structure of the tumor. The malignancy of fibrogenic sarcoma and myxosarcoma is directly proportional to the number of mitotic figures and tumor giant cells which the tumors contain. Of fibrogenic tumors having an equal number of mitotic figures, those with an abundance of fibers are less malignant than those showing less fibrogenic qualities. Cellular spindle-cell sarcomas are all highly malignant, irrespective of the number of mitotic figures, and should be classed as grade 4.

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Fig. 1. Experiment 18. Distal portion of dog's stomach, which has been exposed to tenth normal hydrochloric acid solution and the pyloric region of which had been deprived of most of its blood supply by clamps and ligatures. Congestion, swelling, mucosal hemorrhages, necrosis, and ulcerations are seen in the pyloric region. The mucosa of those portions of the body which had a normal blood supply are normal although they had also been exposed to tenth normal hydrochloric acid solution.

Fig. 4. Experiment 21. Upper portion of dog's stomach. The blood supply of the upper portion had been interfered with by ligation of arteries and tenth normal hydrochloric acid had been injected into the stomach. Hemorrhages and a number of superficial ulcerations surrounded by a grayish borderline are seen.

Surgical Gastritis—A Study of the Genesis of Gastritis Found in Resected Stomachs with Particular Reference to the So-Called "Antral Gastritis" Associated with Ulcer.—R. Schindler, A. Necheles, and R. L. Gold.

SURGICAL GASTRITIS

A Study on the Genesis of Gastritis Found in Resected Stomachs with Particular Reference to the So Called "Antral Gastritis" Associated with Ulcer

R. SCHINDLER, M.D., H. NECHELES, M.D., Ph.D., and R. L. GOLD, M.D.,
Chicago, Illinois

WE have called this paper "Surgical Gastritis" because we have been able to produce a picture of gastritis in dogs using the technique of subtotal gastrectomy and other methods in which we ascertained the presence of a normal stomach before operation. Two different ideas led us to the investigation reported here: (1) The recent discussion on geographical differences in the occurrence of gastritis in stomachs resected for ulcer (Walters and Sebening) has been inconclusive in so far as in this country as well as in Europe results in this field were contradictory. Geographic differences in the gastroscopic picture of the ulcer stomach are denied by Schindler and associates (5). (2) The picture of ulcerative antrum gastritis which Konjetzny and co-workers (1) believe to accompany duodenal and gastric ulcer usually was not found gastroscopically in ulcer bearing stomachs, even not in untreated cases, though occurring as an independent disease (4).

The question, therefore, arises whether the differences in the occurrence and intensity of gastritis in ulcer cases, as reported from different countries, and the discrepancy between anatomical and gastroscopic findings may not be due to differences in surgical technique rather than to differences in the patients. The idea underlying our experiments was that during subtotal gastrectomy the relatively slow deprivation of blood of the stomach of an ulcer patient might produce changes of acute gastritis and erosion at least in such individuals who have a continuous secretion of hydrochloric acid. It has been shown that continuous secretion of acid occurs frequently in persons suffering from duodenal ulcer (7).

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The authors are obliged to Dr. Jerome Strauss for taking the colored photographs.

Dr. Gold is now in San Francisco.

METHODS

Dogs were starved for 24 hours, and anesthetized with ether or with pentobarbital sodium. A small piece of the anterior gastric wall was resected at the border between pyloric antrum and body of the stomach. The opening in the wall of the stomach was closed by sutures and the excised specimen put between filter paper and immediately immersed in 10 per cent formalin. After this various procedures were employed:

1. Excision of the stomachs of anesthetized healthy dogs.

2. Subtotal resection of the stomach. Pylorus and duodenum were separated between clamps and the duodenum was inverted. A rubber covered elastic clamp was applied across the fundus below its upper third; then the blood vessels of the lower two-thirds of the stomach were ligated as usual in gastric resections.

3. Resection of the pyloric antrum only. The same procedure was employed as in 2, but the clamp was placed just above the pyloric antrum.

4. Ligation of arteries. Various arteries supplying the stomach were ligated: the arteria lienalis below the origin of the left gastric artery; the left or right gastric artery on the lesser curvature; the gastro-epiploic artery in the middle of the greater curvature and recurrent branches from the spleen.

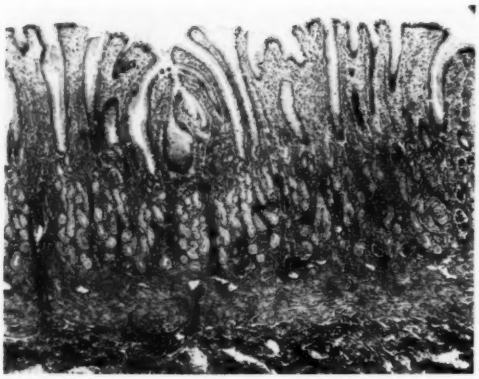

Fig. 2. Experiment 18. Microscopic section of a biopsy, taken from the pyloric portion of the dog's stomach pictured in Figure 1, before the operation.

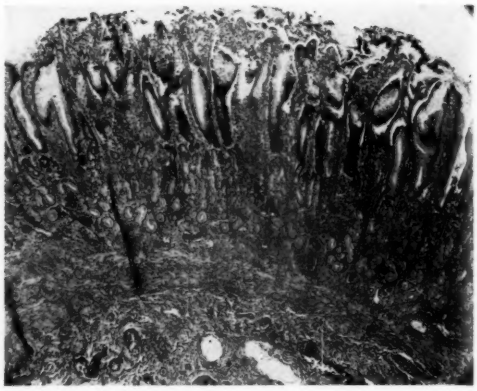

Fig. 3. Experiment 18. Microscopic section through the same region as pictured in Figure 2, but after the operation, showing a superficial erosion.

5 to 8. In none of the experiments presented in groups 1 to 4 was free acid found in the excised stomachs. Using these experiments as controls, the same procedures were repeated with the presence of free acid in the stomachs of the experimental animals. Most patients with duodenal ulcer have not only a high gastric acidity on stimulation, but also a continuous and night secretion of hydrochloric acid. In order to simulate the gastric secretion of acid in the ulcer patient in this group of experiments the following procedures were employed: about 100 cubic centimeters of tenth normal hydrochloric acid was introduced (always by gravity) into the whole stomach or into the segment above the clamp (resections); a small quantity of tenth normal hydrochloric acid was introduced into the part to be resected; or, acid secretion of the stomach was stimulated by subcutaneous injection of histamine or acetyl-beta-methylcholine.[1]

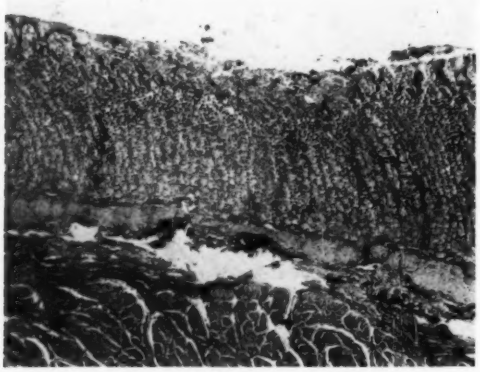

Fig. 5. Experiment 21. Microscopic section through one of the erosions shown in Figure 4. The ulcer floor, especially at the edge of the ulcer, is covered by fibrinous exudate.

In every experiment the dog was covered and left on a heated operating table for about 2 hours after the beginning of the various procedures, i.e., after ligation of arteries and of introduction of the hydrochloric acid into the stomach. This was done in order to simulate the average duration of a gastric resection in a patient by a skillful surgeon. At the end of that period a clamp was applied to the celiac artery and the stomach was excised and opened along the greater curvature. Pieces of tissue were excised and placed in 10 per cent formalin between filter paper. Photographs of the specimen were taken before the natural colors faded out. All these procedures were done within a few minutes after excision of the stomach.

RESULTS

Normal stomachs in which acid secretion had not been stimulated previous to the operation and which did not contain any acid secreted spontaneously or introduced artificially, did not show erosions or other signifi-

[1]Kindly supplied by Merck & Co. (Mecholyl).

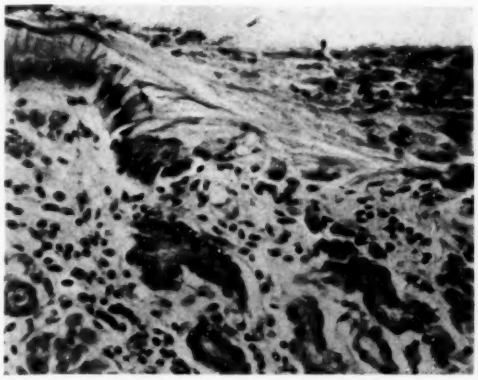

Fig. 6. Experiment 21. Same microscopic section as in Figure 5, higher power. The edge of the ulceration with the fibrinous exudate is seen. The exudate contains cells.

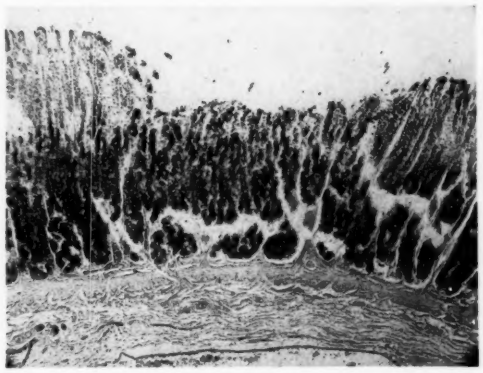

Fig. 7. Experiment 8. Microscopic section through the body mucosa of a dog's stomach. The blood supply of the upper portion of this stomach had been diminished by ligation, and tenth normal hydrochloric acid had been introduced into its lumen. Ulcerations were seen only in that portion of the stomach the blood supply of which had been interfered with. This figure shows a section through one of the ulcerations. Plasma cell staining with methyl-green-pyronin (appearing black in the photograph).

cant pathological changes after the various surgical procedures, i.e., neither after ligation of arteries or partial gastrectomy (using clamps). In the case of controls, using stomachs not operated upon, stimulation of acid secretion of the stomach, or artificial introduction of hydrochloric acid into the gastric cavity did not produce per se any pathological changes either. On the contrary, those parts of the stomach which were deprived in part, or more or less completely, of their blood supply for a duration of 2 hours and which either were exposed to hydrochloric acid by introduction of same or by stimulation of gastric secretion by drugs, showed more or less intense ulcerations, petechiæ, and hemorrhages, according to the degree of anemia of the stomach and according to the degree of acidity prevailing in the resected part. That part of the stomach in which the blood supply was left intact and into which acid had been introduced or into which acid had been secreted following stimulation by drugs, did not show any changes from a normal stomach.[1] Twenty-one operations were performed four of which will be described in detail as illustrative of the general results:

Experiment 18. In this experiment a most thorough occlusion of blood supply to the pylorus was performed as described. Two hours before operation, 3 milligrams of apomorphine hydrochloride was administered, followed in 1 hour by an anesthetic dose of sodium pentobarbital intravenously. The stomach was then washed several times with warm saline. After the peritoneal cavity was entered, blood vessels at the lesser and greater curvature of the antrum were ligated, and the duodenum was sectioned between clamps. A rubber covered elastic clamp was applied at the level of the incisura. Hydrochloric acid, tenth normal (10 c.cm. 38 degrees C.), was in-

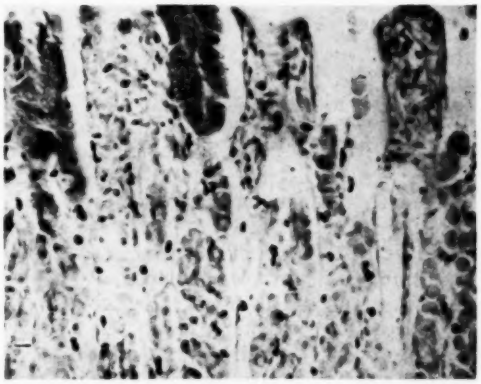

Fig. 8. Experiment 8. Edge of the ulceration of the same section as in Figure 7, under higher power. Many plasma cells are seen as a proof for the rapid inflammatory tissue reaction.

[1]Interestingly, Konjetzny is treating some of his patients with hydrochloric acid pre-operatively. He does not let his patients fast before operation; no atropine is given before operation. During the operation elastic clamps are applied across the upper part of the stomach (2).

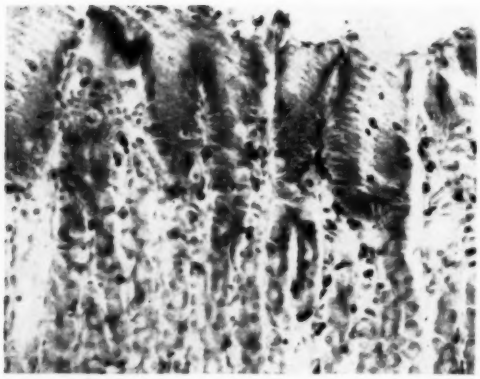

Fig. 9. Experiment 8. Same section as in Figures 7 and 8. Mucosa in the next surroundings of the ulcer. Many plasma cells are still seen here.

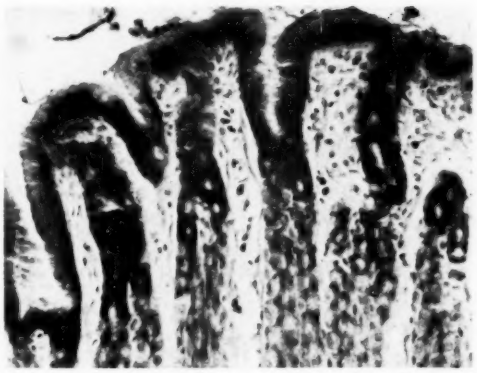

Fig. 10. Experiment 8. Same section as in Figures 7, 8, and 9. Mucosa a few millimeters distant from the ulceration. Almost no plasma cells are seen.

jected into the antrum through the proximal cut end of the duodenum, and 80 cubic centimeters 38 degrees C. was injected into the stomach above the clamp by means of a needle and force of gravity. One and one-half hours after the injection of acid, and 2 hours after the beginning of operation the entire stomach was excised in a few seconds. It was quickly opened on the greater curvature, sections for microscopic study were immediately taken and placed in formalin. The specimen was then photographed only a few minutes after excision and before fading of the natural colors.

Macroscopically, the serosa of the portion of the stomach below the clamp was deeply cyanotic, but of normal color above the clamp. The mucosa above the clamp was normal. Below the clamp most of the mucosa appeared deeply cyanotic, edematous, and covered with hemorrhages, erosions, ulcers, and adherent greenish gray mucus. The specimen and the histology of this experiment are presented in Figures 1, 2, and 3.

As seen in the colored picture (Fig. 1) the lesions are extensive; this was the most radical of our experiments showing most pathological changes. The blood supply to the pyloric antrum had been interrupted nearly completely. However, the musculature of the pylorus of the dog is so powerful, that the application of an elastic clamp does not prevent some blood supply from collateral branches in the gastric wall from entering the segment clamped off. Interestingly, the changes in the distal part of the antrum were less severe than those in its proximal part. A similar picture of a resected human stomach has been reported by Konjetzny (1, Fig. 6, p. 38).

Experiment 21 (Fig. 4). The dog was prepared as described above. The left gastric and splenic and the epiploic and coronary arteries were ligated, the two latter ones at the height of the incisura, so as to interrupt most of the extrinsic circulation to the upper portion of the stomach. One hundred cubic centimeters of tenth normal hydrochloric acid 38 degrees C. was injected into the stomach. Ninety minutes after the beginning of the arterial ligations the stomach was excised. It contained free acid. Sections and photographs were taken as in previous experiment. The serosa and mucosa of the body appeared slightly cyanotic. In the mucosa of the body about 10 small superficial punched out ulcers appeared, most of them on the crest of the folds of the anterior and posterior wall of the body. The antrum appeared completely normal. Interestingly, one of the colored pictures of the same region of a resected human stomach from Konjetzny's material bears strong resemblance to Figure 4 (1, Fig. 2, p. 34). Microscopically (see Figs. 5 and 6) the shallow erosions are seen covered by fibrinous exudate containing cells comparable to observations on resected human stomachs (1, pps. 49–50). This experiment shows that erosions and exudates may appear not only in the antrum (see previous experiment) but also in the body, i.e., wherever the blood supply is deficient and acid present. Also in this case a more or less small amount of blood entered the area whose external supply had been interrupted, through collaterals from the esophagus and from that part of the stomach, whose blood supply had not been interfered with.

The following two experiments serve to show definite tissue reactions (similar to such described by Konjetzny) in the affected tissues, proving that our experimental procedure did not produce corrosion, but a picture of inflammatory reactions similar to gastritis.

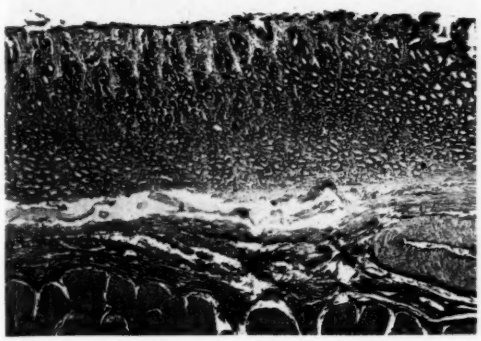

Fig. 11. Experiment 20. Section through the body mucosa of a dog's stomach after subcutaneous injections of histamine and mecholyl, and after ligation of most of the arteries to its left side. Inflammatory ulcerations were produced, this figure showing a section through one of them.

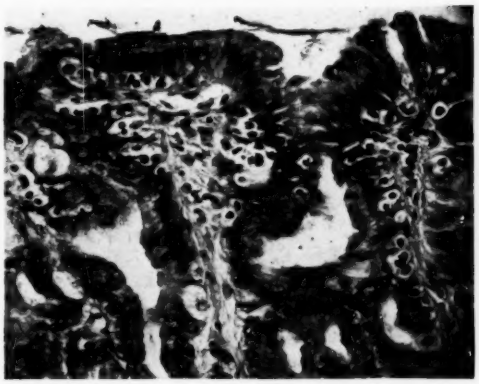

Fig. 12. Experiment 20. This is the same section as shown in Figure 11 only under higher power. The villi at the edge of the ulceration are shown presenting numerous vacuoles and migrating cells which are signs of an inflammatory reaction.

Experiment 8 (Figs. 7–10). The dog was prepared as previously described. The left gastric artery was ligated and 100 cubic centimeters of tenth normal hydrochloric acid 38 degrees C. was injected into the stomach by gravity. Two hours after beginning of ligations the entire stomach was excised and treated as described. In the antrum no ulceration or other pathological changes were present, except some greenish gray mucus at spots. The lower half of the body of the stomach also did not present pathological changes, while in the upper half very distinct changes were seen, which were limited to the lower half by a rather sharp linear demarcation. Irregular erosions were present, some of them confluent, their size being from a few millimeters to 1 centimeter in diameter; two of them looked punched out and had undermined edges. On the upper part of the lesser curvature extensive necrosis was seen. On the posterior wall the same changes were present but to a somewhat lesser extent than those noted elsewhere.

Microscopically rather deep mucosal ulcerations were seen. Plasma cell stain (methylgreen-pyronin) showed accumulation of plasma cells at the base and at the edge of the ulcer, as well as in the immediate adjoining mucosa, but not in the apparently normal mucosa distant from the ulceration.

Experiment 20. Ninety, sixty and thirty minutes before anesthesia with pentobarbital sodium, 1 milligram of histamine hydrochloric acid and 1 milligram of mecholyl were given subcutaneously.

The splenic and left gastric arteries were ligated and the gastro-epliploic artery interrupted by ligature at about the middle of the greater curvature and 2 hours after beginning of the ligations the stomach was excised and treated as described. The mucosa above the angulus appeared cyanotic. In the highest portion of the body of the stomach numerous erosions, small ulcers, hemorrhages, and areas of necrosis were evident. The number of ulcers was diminishing toward the antrum pyloris. The antrum itself appeared entirely normal.

Microscopically, shallow ulcers are seen. Figure 11 shows the erosion and Figure 12 the mucosa next to its edge, demonstrating the inflammatory reaction of the tissues, while the mucosa distal to the ulcer appears normal (Fig. 13).

This experiment again demonstrates that inflammatory reaction can occur during an operation and need not be interpreted as gastritis of older standing. Photomicroscopic pictures similar to ours on the dog's stomach (Fig. 12) can be found in resected human stomachs.

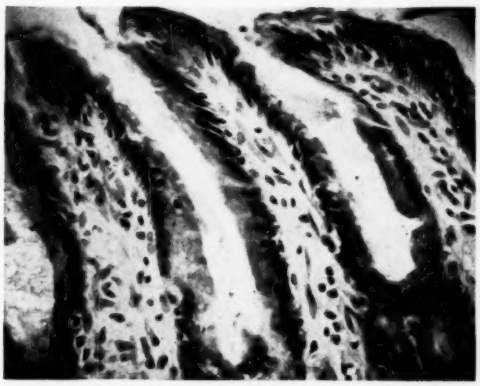

Fig. 13. Experiment 20. Same section as in Figures 11 and 12. Villi distant from the ulcer, showing very few vacuoles and migratory cells.

DISCUSSION AND CONCLUSIONS

We were fully aware that the pathophysiology of the dog's stomach is different from that of the human. The occurrence of chronic peptic ulcer in dogs is extremely rare, although the condition of chronic gastritis is not found infrequently in street dogs we were using. We want to stress also that existing pathological conditions in human stomachs will be superimposed by the ulcerative and inflammatory reactions occurring during operation as described, and thereby such stomachs may present pictures more complex and shifting than those of our relatively simple experiments. Yet we feel confident that part of our experience can be applied toward the explanation of geographic differences in the occurrence of gastritis in ulcer patients, as well as to the problem of gastritis in relation to the genesis of ulcer. It has been claimed by Konjetzny that results of autopsies are not dependable because these do not take place immediately after exitus, and postmortem changes in the stomach are unavoidable. He believes that stomachs resected by the surgeon offer an incontroversial proof for the pre-operative condition of the mucosa because they are absolutely fresh and not subject to postmortem changes. It seems to us, however, that the same logic as to postmortem changes may be applied to the specimen of gastric resections and we believe that we have proved this with our experiments, and have demonstrated it with the colored pictures and photomicrographs. Our colored pictures and some of our photomicrographs may well be compared with those Konjetzny obtained from his surgical specimens. A stomach partially or totally deprived of its blood supply will show within 2 hours, erosions, ulcerations, and inflammatory reaction of the tissue, i.e., gastritis in varying degrees, depending on the presence of acid during the operation.

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THE PROBLEM OF INTRACTABLE PEPTIC ULCER

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PEPTIC ulcer in its uncomplicated state is fundamentally a physiological, biochemical problem calling for a restitution of normal function. Such a return to normal can usually be accomplished by proper medical measures, aided, if necessary, by the proper form of surgical care. The basic rationale of treatment has been the neutralization of secreted hydrochloric acid, and this may be accomplished by a great variety of methods. But intractable or recurrent peptic ulcers, as the name implies, do not respond satisfactorily to either medical or surgical treatment alone; they remain medical problems after surgical treatment as well as before. A clearer understanding of the etiology of peptic ulcer is urgently needed, but until such an understanding is accomplished, efforts should be directed toward an earlier recognition of intractable duodenal ulcers, thereby decreasing the frequency of their treatment by gastro-enterostomy and in turn reducing the incidence of the development of jejunal ulcers.

Recurrent, intractable peptic ulcer may be considered as a general disease with a local, usually duodenal, lesion occurring most frequently in young, slender, active, ambitious males with labile nervous and vascular systems. There is often a history of ulcer among other members of the family. Among the usual symptoms of ulcer are gastric hyperchlorhydria, hypersecretion, and hypermotility; hemorrhage or perforation, which are not infrequent, may occur without any premonitory digestive complaints. Medical management admittedly fails. The operative treatment, usually gastro-enterostomy, has not only been unsuccessful, but a resultant jejunal ulcer has often occurred which may be more serious than the original ulcer. In fact, the frequency of intractable ulcer may be roughly gauged by the percentage of jejunal ulcers which follow gastro-enterostomy, variously estimated at from 3 to 34 per cent. Resections of various amounts of the distal stomach have been followed also by recurrence, and other seemingly radical measures have often proved to be merely palliative.

The rational treatment of any disease presupposes a known cause, but unfortunately in the case of peptic ulcer no theory of cause yet propounded can be wholly accepted. In the 50 or more current theories hydrochloric acid seems to act as a common denominator. Hydrochloric acid is the main important causative factor, because of a disproportion in the ulcer patient between the aggressive, or acid, and the defensive, or alkaline, secretions. The proper treatment of intractable ulcer, therefore, might well aim to diminish the secretion of hydrochloric acid, in contradistinction to its mere neutralization after secretion, which is usually satisfactory with tractable cases. In fact, such an objective has been attempted by both non-operative and operative methods.

In the search for an ideal non-operative treatment, a physiological method of reducing hydrochloric acid secretion is urgently needed. Belladonna and atropine are useful but because of objectionable oral, ocular, and cardiac effects, they are not suitable for prolonged treatment and many modifications of the drugs are being developed. The action of adrenalin and ephedrine is transitory. Risking a resultant anemia, anti-secretagogues might be found useful if they were clinically applicable, and enterogastrone of Ivy and histaminase of Banting and Best, when eventually purified for clinical use, are promising. Bromides have been given in the hope of substituting hydrobromic acid for hydrochloric acid in the gastric secretion. The dietary increase of fats is a well recognized adjunct to treatment. Also, the low salt diet suggests itself in the treatment of peptic ulcer, but after trial the desired hypochlorhydria has not been clinically demonstrable, probably due to the large salt reserves in the body fluids. That psychotherapy is of actual value is shown frequently by the immediately favor-

Fig. 1. *A*, Jejunal ulcer, filling defect at stoma; *B*, diverticulum in proximal limb of jejunal loop; *C*, entero-enterostomy.

able result of a vacation, rest, or simply change of environment. Physiotherapy, x-ray, vitamin, hormone, enzyme, vaccine, protein shock, endocrine, and numerous other types of treatment are on trial.

Equally as disappointing as any such conservative measures are the operative procedures which are in common usage. Vagus resection influences but one type of gastric stimulation, the psychic, and it has not proved to be of clinical value. After partial sympathectomy permanent changes in gastric secretion have not been demonstrated. Ligation of gastric blood vessels and removal of gastric mucosa have not been satisfactory. The gastrin theory of Edkins, i.e., that an antral or pyloric hormone stimulates fundal acid secretion, has served as the basis for distal gastrectomy, but the existence of such a hormone has been questioned and its definite distinction from histamine has not as yet been demonstrated. It remains then only a theory which is unconfirmed experimentally and clinically. But granting the existence of gastrin and its isolation from histamine, the removal of this gastric hormonal stimulant seems to be rapidly compensated for after operation by the still present intestinal stimulants to gastric acid secretion, that is, the duodenal contents, the secretions of the liver, pancreas, Brunner's glands, and jejunal mucosa. The extension of distal partial gastrectomies to include a portion of the proximal fundus has improved results, but it has not been entirely satisfactory.

From the standpoint of gross and histological structure, as well as of function, the stomach may be considered as a double organ, an alkaline secreting antrum and an acid secreting fundus. The muscular, vascular, and nervous arrangements all lend themselves admirably to an operative modification of the relationship between these 2 portions of the stomach. In view of these facts, and after careful autopsy study and animal experimentation, partial, or proximal, gastrectomy, or, more properly, partial fundusectomy, was suggested in 1929 for certain types of peptic ulcer. This operation not only minimizes the area capable of secreting the aggressive acid, but in addition it preserves the defensive alkaline secreting antrum, with the neuromuscular mechanism of the lesser curvature and the pylorus. This procedure, with suitable dietary and hygienic measures, has been carried out clinically upon 17 patients with lesions classed as intractable. The results have been very satisfactory, despite the return of secretion and of the stomach to about normal (1, 2). The following case is particularly illustrative of the complications of intractable ulcer and its favorable response to "fundusectomy":

CASE REPORT

P.R., aged 33 years, had had typical peptic ulcer symptoms since 1927 when he was 17 years of age. In 1927, he had an appendectomy and gastro-enterostomy for duodenal ulcer, with resultant relief for 5 years. In 1932, following a hemorrhage, he had a degastro-enterostomy, excision of a jejunal ulcer, and a new gastro-enterostomy. Again he was relieved, this time for 2 years. In 1934, he had an entero-enterostomy without relief, and in 1937 he again suffered an acute hemorrhage. Atypical symptoms persisted until September, 1938, when he first came under our observation. He was complaining of pain, epigastric tenderness, "heartburn," nausea,

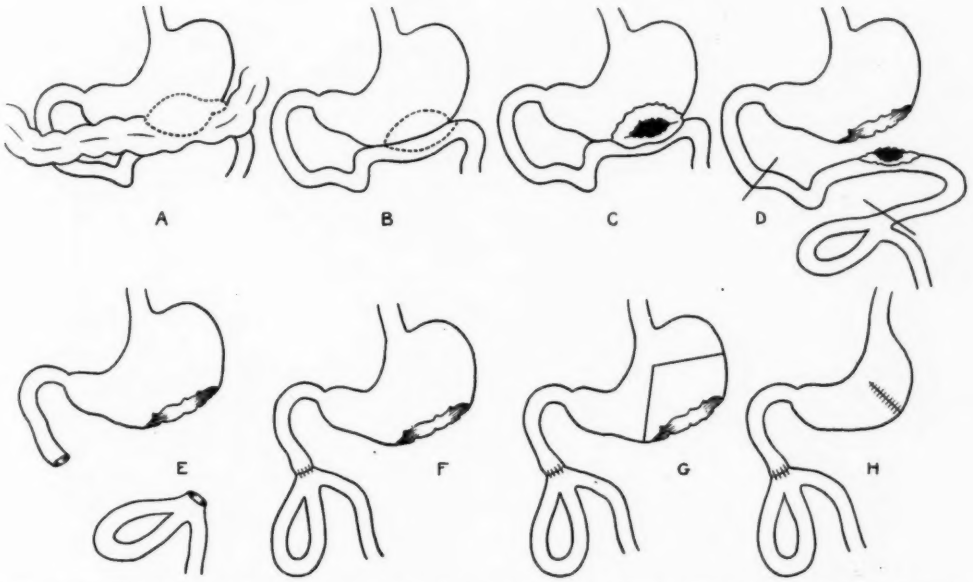

Fig. 2. *A*, Mass at stoma; *B* after separation of colon; *C*, degastro-enterostomy, exposing ulcer; *D*, degastro-enterostomy completed and previous entero-enterostomy; *E*, excision of jejunum and ulcer; *F*, end-to-side enterorrhaphy to establish continuity of bowel; *G* and *H*, partial fundusectomy. To have merely repaired gastric defect would have re-established conditions as they were before the development of the first peptic ulcer.

and frequent vomiting. He obtained no relief upon the taking of food, and there was no periodicity of symptoms. He was thin, emaciated, and dehydrated. Laboratory tests revealed a hyperchlorhydria, melena, and secondary anemia. There was a large tender mass in the epigastrium, and the x-ray showed a filling defect and a diverticulum at the stoma. The pylorus was patent. The diagnosis was that of jejunal ulcer at the stoma, and treatment consisted of excision of the ulcer with partial gastrectomy, or fundusectomy. Four months after operation he was symptom free and had gained 21 pounds.

As might be expected, laparotomy revealed many omental adhesions to the stomach, liver, gall bladder, and the abdominal wall. The mobilized pylorus was found to be thickened but not stippled, and the gall bladder, foramen of Winslow, and pancreas were normal on palpation. A golf ball sized mass was found, consisting of omentum, transverse colon, stomach, jejunum, stoma, and ulcer, and upon separation of the colon which was firmly adherent at the stoma, a threatening gastrojejunocolic fistula was found (Fig. 2A). At the site of the ulcer the visceral wall was thickened and edematous with stippling of the serosa (Fig. 2B). Degastro-enterostomy was done, with exposure of the jejunal ulcer, during the course of which 3 inches of linen suture, which had been in place for 6 years, were removed (Fig. 2C). The gastric side of the stoma showed no ulceration, and the pylorus was patent. A previously established entero-enterostomy 8 inches from the stoma could be demonstrated (Fig. 2D). Made originally for the relief of the "vicious circle" this anastomosis had been misapplied, for with both limbs of the loop distal to the stoma it could not possibly exert any beneficial influence. The jejunal ulcer was removed with adjacent jejunum and intestinal continuity was re-established by end-to-side enterorrhaphy at the site of the previous entero-enterostomy (Fig. 2E and F).

In order to eliminate the possibility of return of conditions as they were before the first ulcer, some means of prevention of recurrence was sought, such as the reduction of hydrochloric acid secretion, and minimization of the proximal, or acid secreting, portion of the stomach seemed to fulfill the indications. Therefore, a major portion of the greater curvature of the fundus including the stomal opening was removed in a triangular piece, preserving the alkaline secreting antrum and the neuromusculature of the lesser curvature and of the pylorus (Fig. 2G). After careful hemostasis the continuity of the stomach was re-established by suture of the remaining distal and proximal portions with two rows of catgut sutures, one through-and-through for hemostasis and security, the other for seroserous apposition (Fig. 2H). The abdomen was closed without drainage.

EVALUATION OF THE OPERATIVE TREATMENT

Based upon my experience with 28 cases of jejunal ulcer, an evaluation of the results of the operative treatment of intractable peptic ulcer is attempted. These cases have been reviewed after a careful follow-up study. Except for one instance of congenital stenosis, they developed jejunal ulcer after gastro-enterostomy for duodenal ulcer. The number of operations following gastro-enterostomy were as follows: 1 in 17 patients, 2 in 7 patients, and 3 in 4 patients. Twenty-two were males and 6 were females. The ages varied from infancy to 62 years. The results of the treatment may be conveniently classed under 3 divisions:

A. In 18 of these patients a new gastro-enterostomy was made, posteriorly in 17, and anteriorly in 1. Entero-enterostomy was added in 2 and jejunostomy in 1. There was a return of symptoms in all 18 patients.

B. In 6 of the patients the original gastro-enterostomy remains. Of these, 2 underwent gall-bladder operations, 2 had an entero-enterostomy, 1 had a "pyloric exclusion," and 1 simply had separation of adhesions. There was a return of symptoms in all 6 patients.

C. In the remaining 4 patients a partial proximal gastrectomy, or fundusectomy, was performed. In 3 patients there have been no return of symptoms after 4 months, 3 years, and 7 years, respectively. The fourth patient died of postoperative uremia.

In contrast to these 4 patients treated by fundusectomy, 13 distal gastrectomies resulted in death in 3 patients, the return of symptoms in 8 patients, and unknown results in 2 patients. Although this series is obviously too small on which to argue the comparative benefits of fundusectomy, it is indicated that this form of operation for the cure of recurrent peptic ulcer may be on a sound physiological basis.

SUMMARY

Intractable peptic ulcers, as the name implies, do not respond satisfactorily to either ordinary medical management or the usual operative treatment. The symptoms which they produce and the type of individuals in which they occur suggest that they may be considered a general disease with a local lesion. Satisfactory non-operative treatment awaits the development of a clinically applicable antisecretagogue with which to diminish the secretion of hydrochloric acid, in contradistinction to its neutralization by food or alkalis after secretion, which, with other non-operative measures, is usually satisfactory in tractable ulcers. The usual operative treatment is gastro-enterostomy, but this may be followed by jejunal ulcer and other complications far worse than the original condition. A rational operative treatment is one that diminishes the secretion of the hydrochloric acid, rather than one that chiefly promotes neutralization, and in this respect fundusectomy, a modification of subtotal gastrectomy by preservation of the distal stomach and lesser curvature, is followed by promising results.

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SURGICAL TREATMENT OF ACUTE PROFUSE GASTRIC HEMORRHAGES

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FORTY-TWO years ago Mikulicz and later Kroenlein expressed the view that operation for acute, profuse gastric hemorrhage is more dangerous than expectant treatment and that operation should be postponed until the patient recovers from the great loss of blood. They believed that only the presence of a secondary anemia caused by repeated small hemorrhages was an absolute indication for operative interference. Twenty years ago I suggested early operation as the treatment of choice for hemorrhage from a chronic ulcer because such hemorrhage, coming from an eroded large artery at the base of a penetrating ulcer, could be stopped permanently only in this manner. This proposal was rejected not only by internists but also by some surgeons, Clairmont, for instance. Singer was the only internist who believed that acute profuse hemorrhage was "the most surgical complication" of gastric ulcer. Poor results following conservative treatment gradually induced several surgeons, such as Friedemann, Haberer, Pannet, and Petermann, to adopt surgical intervention in the treatment of bleeding ulcers. The subject was discussed at the Congress of the French Surgical Society in 1933 and the main speakers—Papin and Willmoth—advocated operation unless the bleeding stopped within 48 hours after blood transfusion. Gordon-Taylor of the Middlesex Hospital in London reported a 21 per cent mortality after conservative treatment and was able to reduce the mortality to 9 per cent after he began operating early. Of 22 cases he lost only 2.

I have repeatedly demonstrated the falsity of the statement that the results following conservative treatment are superior to those following operative procedures. Such statements are usually based on comparisons of not identical cases. All cases, including patients with slight hemorrhage were included in with the conservatively treated group, hence the mortality did not exceed 2 to 5 per cent. If only the patients with grave gastric hemorrhages causing fainting spells, with a hemoglobin index below 40 per cent and the erythrocyte count below 2½ millions, are considered, the mortality rises from 3 per cent, as reported by Miller, of Philadelphia, to at least 11 to 25 per cent or more. Aitken, from the London Hospital, reported 11 per cent mortality among his 255 cases of acute hemorrhage; while all 192 patients with only slight bleeding recovered, of 63 with grave hemorrhage 27, or 43 per cent, died. Of the conservatively treated 31 patients, 17, or 54.8 per cent, expired; of 11 cases in which in addition blood transfusion had been performed, 3, or 27.2 per cent, succumbed to the hemorrhage. Of 21 patients in whom after unsuccessful internal treatment late operation, chiefly a gastro-enterostomy, had been performed, 7, or 33.3 per cent, expired. Chiesman, of St. Thomas Hospital in London, reported 25 per cent mortality in his series consisting of 191 patients with acute gastric hemorrhages. Of 129 patients who bled only 1 day, only 2 patients, or 1.5 per cent, died while of 62 cases bleeding 2 or more days, 46 patients, or 74 per cent, expired. At autopsy erosion of a large blood vessel, such as the left gastric or pancreaticoduodenal artery, was found at the base of an ulcer penetrating into the pancreas in 45 instances. The age of the patient is very important. Of 11 patients younger than 40 years, 7, or 63 per cent, died; of 40 patients at the age of 40 to 60 years, 28, or 70 per cent, died. All 11 patients older than 60 years died in spite of internal therapy. Ross, of Melbourn, observed 58 per cent mortality in 45 cases with grave hemorrhage.

In the cases reported in the literature in which surgical treatment was used, operation

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was usually performed only after internal treatment over a period of several days failed to stop the hemorrhage. In the majority of cases gastro-enterostomy was performed although hemorrhage can almost never be stopped by such a procedure. The deaths resulting from severe anemia are not considered in the statistics of conservatively treated patients since these patients with continuing bleeding were finally subjected to operation, and increased the operative mortality. Lynch, of Montreal, compares the mortality rates of his 31 patients conservatively treated, which was 12.9 per cent, with the operative mortality rate, 42.8 per cent, and draws the conclusion that the conservative treatment is superior to the surgical. He does not draw attention, however, to the fact that the operation was performed only in the late stages when all other attempts to stop hemorrhage proved futile.

It is impossible to compare the 2 groups of cases, first, because no internist restricts treatment solely to conservative measures but refers patients with persistent hemorrhage to the surgeon, and, second, because the surgeon seldom has the opportunity to operate upon such patients in early stages of the disease. If comparisons are to be made, only results after early operation performed during the first 24 to 48 hours and without preliminary attempt to treat them conservatively—should be considered. Of 22 cases Gordon-Taylor had only 2 fatalities, or 9 per cent; Oliani lost only 1 patient of pneumonia and 9 recovered.

In my experience the mortality rate after early operations averages 5.1 per cent: of 7 patients having gastro-enterostomies 1 expired, and of 71 patients having gastric resection 3 died from 6 to 20 days after operation. My statistical material includes also cases in which patients were suffering with severe hemorrhages due to erosion of the pancreaticoduodenal artery. It is evident that it is much safer to operate immediately and to ligate a large eroded blood vessel than to perform a blood transfusion and see whether the patient continues bleeding or not.

Internists assert that hemorrhage as the cause of death is so rare that it should not be considered as an indication for an operation. They claim that conservative treatment is never followed by a fatal outcome. This is true only if no large artery be eroded. Hemorrhage from a flat mucosal ulcer nearly always stops after conservative treatment or a blood transfusion and in such cases death is rare. Hemorrhage from a mucosal blood vessel in a callous ulcer may also be checked without operation; but this is not true if the bleeding originates in a large eroded artery outside the stomach or duodenum. In such cases the hemorrhage lasts many days and, according to Chiesman, the mortality rate after conservative treatment reaches 74 per cent. In his material, of 46 fatal cases autopsy revealed erosion of a blood vessel in 45. A mortality rate of 74 per cent contradicts the statement that, with medical treatment, death from a hemorrhage is rare. I have observed more than 10 patients who succumbed to acute gastric hemorrhage after they had been unsuccessfully treated in a conservative manner. In 2 cases I was not able to operate because in one resection of the cecum had been done for tuberculosis and in the other appendectomy for a perforated appendix preceded the hemorrhage and in neither could resection of the stomach be considered because of the danger of causing peritonitis from suppurating wounds. The second mentioned patient died from a hemorrhage despite the fact that three blood transfusions were given. Postmortem examination revealed in this patient, who had suffered for 10 years with an old duodenal ulcer, erosion of a large blood vessel.

Grave hemorrhages start usually in duodenal ulcers, although Kalk claims that in his conservatively treated patients the bleeding occurred more frequently from gastric ulcer and was more dangerous than a hemorrhage from a duodenal ulcer.

It has been stated that the diagnosis of a bleeding ulcer is very difficult because fatal hemorrhages may have an entirely different source. According to a generally accepted principle the attention of the physician should be focused not on the exceptions but on the most frequent conditions. According to Bulmer, in over 90 per cent of all acute gastric

hemorrhages, chronic ulcers were found and therefore ulcers should always be suspected even if very few complaints are found in the history and the x-ray findings are negative. In doubtful cases, exploratory laparotomy under local anesthesia is much safer than expectant treatment after blood transfusion. If a gastric ulcer cannot be diagnosed from external inspection, gastrotomy should be performed and the mucosa carefully palpated in order to locate, if present, a penetrating ulcer on the posterior wall of the duodenum, for such an ulcer is particularly dangerous. Exploratory laparotomy may reveal other causes of an acute gastric hemorrhage. In a 60 year old man, in addition to a grave liver cirrhosis, I found a callous ulcer of the lesser curvature, which had not previously been recognized. This patient was cured by a typical resection; without operation the patient would have died from a hemorrhage from an eroded vein. Hemorrhage from a dilated esophageal varicosity caused by liver cirrhosis cannot be stopped by operation, but exploratory laparotomy performed under local anesthesia is harmless in such cases and makes possible the exclusion of hemorrhage from a callous ulcer. If exploration discloses bleeding from a flat ulcer and erosive gastritis, which is seldom the case, the typical gastric resection removes the inflamed mucosa of the antrum so that not only the hemorrhage ceases but a permanent cure is obtained. Neugebauer reported several such cases. I performed late operation for acute hemorrhage in 3 cases in which gastritis was found to be the cause of grave hemorrhage of several days' duration. All 3 patients were permanently cured. Cancer of the stomach very rarely causes profuse hemorrhage. I have performed gastric resection in 710 cases of carcinoma and in only 3 were acute hemorrhages observed before the operation. Once I saw a severe hemorrhage from an eroded cystic artery. The erosion was caused by an ulcer produced by a large gall stone; at operation the stomach was found to be empty but the common duct and the small and large intestines were filled with blood. Cholecystectomy was preceded and followed by a blood transfusion and the patient was saved.

Internists also claim that, even if an ulcer is found at operation, the hemorrhage cannot be permanently stopped if the bleeding originated in an eroded blood vessel. The surgical results contradict this statement, however. The various methods of stopping the hemorrhage which the surgeon has at his disposal will be discussed later. If a large artery is eroded, the perforation, the size of a pinhead, is usually closed by a thrombus after the blood pressure falls as a result of collapse. The bleeding temporarily stops but recurs after 2 to 3 days when the thrombus has been digested by hydrochloric acid. In such cases the mortality rate after conservative treatment reaches 74 per cent according to Chiesman, and at autopsy an eroded artery can be found at the base of a penetrating ulcer. If early operation is performed in such cases a few hours after the onset of the bleeding, as soon as the patient recovers from the collapse, the entire base of the ulcer is found covered with blood coagulum which closes the small perforation in the artery; after its removal the blood spurts from the blood vessel. Cessation of the hemorrhage can be accomplished relatively easily by double ligation of the exposed artery. In 8 instances I was able to ligate the eroded pancreaticoduodenal artery successfully and to perform a typical resection. However, if the operation is performed late after repeated grave hemorrhages, the hemorrhage can also be stopped, but the severe anemia which follows may be fatal. Even in the presence of hemorrhage from a large artery, death does not necessarily take place immediately, as may be seen from the fact that, according to Tuffier, hemorrhage from a splenic artery may last 24 to 48 hours and even as long as 7 days. Erosion of the left ventricle is known to have caused hemorrhages of 10 days' duration in 2 patients with ulcers penetrating the diaphragms. The cases were reported by Brenner and Oser. It follows that there is sufficient time to prepare the patient and to perform an operation even in the presence of an erosion of a large blood vessel.

The diagnosis of a gastric hemorrhage from a chronic ulcer can usually be made from the history and the roentgenological findings be-

cause, according to Kalk, massive hemorrhages without previous symptoms are rare and in the majority of the cases the bleeding comes from chronic ulcers. This point is of great importance in deciding whether or not to operate. In doubtful cases consultation with an experienced internist is to be recommended.

The indications for operation depend on whether the hemorrhage is the first symptom or whether it was preceded by serious complaints. Tidy asserted that I operate in each case of gastric hemorrhage even though the bleeding is slight and no other complaints are present. If there is no hemorrhage gastric operation is not indicated; I recommend expectant treatment under the supervision of an experienced internist, and, if necessary, such treatment may be supported by blood transfusion. Such patients are usually young, and most of them are women. I have never observed a fatal case in this group since no callous or penetrating ulcers have been noticed in this material. Only in old people who have large ulcers but have no serious symptoms, is an exploratory laparotomy under local anesthesia safer than expectant treatment.

If chronic ulcer has been diagnosed clinically and roentgenologically and the hemorrhage is grave, I advise immediate operation because the results of early operation are nearly as good as those of a common gastric resection. I recommended early operation 16 years ago because the results were very good. This statement has been confirmed by Gordon-Taylor. Early operation avoids not only the danger of secondary perforation but also the harmful effects of a prolonged anemia resulting from repeated hemorrhages. Grave damage to the liver, kidneys, heart, brain, and other viscera, may interfere with the beneficial effect of a postponed operation. Furthermore death from successive hemorrhages, to be feared when continuous pain has preceded the hemorrhage, can be avoided. Such continuous pains usually point to hemorrhage from a penetrating ulcer. In such cases the bleeding may arise from a small artery in the mucosa of the margin of an ulcer or from a large artery at the base of the ulcer, and in view of the fact that the location of the source of the bleeding cannot be established without operation, I advocate early surgical interference and avoid, in a majority of cases, a blood transfusion even if the anemia is very pronounced, e.g., if hemoglobin is only 30 per cent and erythrocytes number 2,000,000.

If the diagnosis of hemorrhage from a chronic ulcer is doubtful I recommend exploratory laparotomy, especially in elderly patients. Usually in such instances a previously silent ulcer is found and resection is performed. If in such cases instead of operation blood transfusion is performed, as was recommended in 1933 at the Congress of the French Surgical Society, no great benefit is derived if an erosion of a large artery is present because the hemostatic effect of a transfusion has not yet been definitely demonstrated. Reschke sent out a questionnaire to the Berlin hospitals and found that 50 per cent of patients treated with a blood transfusion died. Possibly continuous venoclysis, with citrated blood as advocated by Marriot and Keckwick, of the Middlesex Hospital, is more successful in such instances.

If, after unsuccessful conservative treatment, patients with recurrent hemorrhages are sent in for operation I advise expectant treatment if it is probable that the hemorrhage has ceased. I have assumed this attitude because the anemia, which is responsible for damage to vital internal organs, may interfere with the operative results and because the untoward effects of anemia may be intensified by operation. At autopsy upon such non-operated upon patients no blood is shown in the intestines and the eroded blood vessel is temporarily occluded by a thrombus. If hemorrhage does not stop spontaneously, operation with ligation of the bleeding vessels is indicated, in spite of the seriousness of such a procedure.

The main purpose of operative treatment in the presence of acute gastric hemorrhage is reliable hemostasis, the question of permanent cure of the ulcer being of a secondary importance. For the purpose of hemostasis a gastro-enterostomy is performed; in cases with a bleeding duodenal ulcer, it was per-

formed, combined with ligation of the pylorus, by many surgeons, but it should be remembered that a gastro-enterostomy has only an indirect hemostatic effect by causing a continuous emptying of the stomach through the new stoma and facilitating in this manner the permanent contractions of the stomach. It follows that gastro-enterostomy may be effective only in hemorrhages from a flat ulcer but never if bleeding comes from an ulcer penetrating into the pancreas. While an assistant of Hochenegg, I had to perform a gastro-enterostomy, because resection of the ulcer was forbidden. Two patients died from a continuation of the hemorrhage and at the autopsy in one case an eroded pancreatic artery and in the second case an eroded splenic artery was found.

If at operation a gastric ulcer penetrating into the pancreas is found, the stomach is separated from the base of the ulcer and the bleeding vessel is ligated. It depends on the general condition of the patient whether the margins of the ulcer are simply excised and the stomach is sutured or a typical gastric resection is performed. If a duodenal ulcer penetrating into the pancreas is not resectable on account of its position and extent, I do not perform resection for exclusion of the ulcer but substitute for it a simple ligation of the pylorus combined with a posterior gastro-enterostomy. Compression is applied to the duodenal region by means of a large tampon placed directly over the duodenum so that it causes a protrusion of the anterior abdominal wall. A tight bandage presses this tampon against the duodenum and the posterior abdominal wall. Thus direct pressure produces a hemostatic effect. After 24 hours the pressure must be released by loosening the bandages to avoid damage to the pancreas. I used this method in 11 cases; in 2, early operation was performed and the patients recovered while of the 9 patients in whom the operation was performed later, 3 died of anemia. The hemostasis was perfect in the first patient, who died 10 hours after operation. Autopsy showed no blood in the small intestines although they were filled with blood at the time of the operation. The second patient succumbed after 3 days from pulmonary embolism and the third patient died after 4 weeks from an acute psychosis. This simple method is efficient when direct hemostasis by resection or ligation of the bleeding vessel is impossible.

Excision of a bleeding gastric ulcer can always be performed and has a perfect hemostatic effect. If, however, the condition of the patient allows it, instead of excision a typical gastric resection should be done, this guaranteeing a permanent cure. Although this operation is generally considered to be dangerous, it is well tolerated by exsanguinated patients. The mortality rate depends upon the duration of the grave hemorrhage. If early operation is performed within the first 24 to 48 hours, damage to the parenchymatous organs by the anemia may still not have occurred and the results are good even if the hemorrhage has been severe or the patient is old. Of 78 cases in my series only 4, or 5.1 per cent, died. While in the group of 7 gastro-enterostomies 1 patient succumbed to a continuous hemorrhage from the pancreatic artery, of 71 cases with gastric resection 3 patients, or 4.2 per cent, died.

An 80 year old patient had had gastric complaints for 40 years. Later the pains became more intense and the patient had been vomiting repeatedly and had lost 34 kilograms. On account of the presence of a complete pyloric stenosis the patient was scheduled for a gastro-enterostomy but the night before the operation he collapsed. The following morning his pulse was 130, of poor quality, and the stomach was completely filled with fluid. Aspiration of gastric contents showed blood and therefore immediate operation was decided and was performed under local anesthesia, a 0.25 per cent novocain solution being used. Paracentesis of the exposed enormously dilated stomach furnished 4 liters of blood and gastric juice. A large, callous ulcer, reaching the pancreas, was found on the lesser curvature and another ulcer in the pyloric region. A resection of the duodenum and one-half of the stomach and a Hofmeister-Finsterer's anastomosis were performed. The pulse immediately after the operation was 136, the following day 100, and the third day 80. The patient felt perfectly well and on the third postoperative day was out of bed, had a normal bowel movement, and was passing flatus. Eight days after the operation he suddenly developed a chill, his temperature rose to 102.2 degrees, and on the tenth day he died from bilateral pneumonia.

A 48 year old man had been suffering from stomach complaints for 6 years and was repeatedly treated for a duodenal ulcer. Three months before his entry into the hospital he developed a grave hemorrhage and fainted and after that he was practically symptom-free. Three days before admission he developed influenza with fever, and 2 days later vomited blood and passed bloody stools. The patient fainted repeatedly and 12 hours after the onset of the hemorrhage was brought in an automobile to Vienna

over a distance of 40 kilometers. The blood count showed 2,300,000 erythrocytes; hemoglobin, 30 per cent, pulse, 126 and of poor quality. An immediate operation was performed under splanchnic anesthesia, with 0.25 per cent novocain. One ulcer was found on the anterior wall of the duodenum ready to perforate; another ulcer penetrating into the pancreas was located on the posterior duodenal wall; the stomach was empty but the entire small and large intestines were filled with blood. Resection of the ulcer was performed and the ulcer base was left *in situ*. After the duodenum had been separated from the ulcer base a severe hemorrhage developed from the eroded pancreaticoduodenal artery which was ligated and the duodenum closed; two-thirds of the stomach were resected and Hofmeister-Finsterer anastomosis was performed; one drain was inserted. No abdominal complications developed but a grave febrile bronchitis became transformed into a bilateral pneumonia. The patient expired 3 weeks after the operation from the influenza and pneumonia.

A woman 46 years of age was in perfect health until 3 weeks before the admission to the hospital when she developed pains and vomiting on account of which she was admitted to the medical department of the General Hospital in Vienna. At that time the gastric acidity was 53/78; blood was present in the stools. Two weeks later she suddenly vomited a large amount of bright red blood and collapsed. Forty-five minutes later she vomited again and the frequency of the pulse rose to 120/130. During the transfer to the surgical department she again vomited bright red blood and collapsed. Examination in the operating room showed a mentally confused, restless patient with air hunger; pulse, 160 and hardly palpable. An immediate operation was performed under local anesthesia—0.25 per cent novocain solution. During the operation a transfusion of 750 cubic centimeters of blood was given. The stomach and the small and large intestines were completely filled with blood. A duodenal ulcer penetrating into the pancreas was found and the duodenum was separated from the base of the ulcer which was covered with blood coagulum. As soon as the latter was removed, bright red blood spurted from a laterally eroded pancreaticoduodenal artery. The diameters of the ulcer base were 21 by 1 by 0.5 centimeter. The artery was ligated, the duodenum was closed, two-thirds of the stomach was resected, an end-to-side Hofmeister-Finsterer anastomosis was performed, and a drain was placed at the base of the ulcer. The following day the pulse was 108, next 90. As the patient vomited black masses, gastric lavage was given on the first postoperative day. Three days after operation the patient developed bilateral pneumonia and she expired on the sixth day. The autopsy revealed a diffuse, suppurative bronchitis, a confluent bronchopneumonia of both lower lobes, and a bilateral suppurative pleurisy. There were signs of a grave secondary anemia. The ligated blood vessel was the main trunk of the pancreaticoduodenal artery. The anastomosis was in perfect shape. As the patient was transferred in winter time from the medical to the surgical department located in another building she probably caught a cold with the resulting bilateral pneumonia which the weakened organism was not able to overcome.

The results from early operation were much better than those from conservative treatment although the ages of 11 patients ranged from 60 to 80 years. As in 8 cases, erosion of the main trunk of the pancreaticoduodenal artery was present and under such circumstances only an operation could have stopped the bleeding, probably of the 71 cases of resection at least 12 to 20 per cent would have died, had they been treated conservatively. Operation, however, was followed by a mortality of 4.2 per cent. In view of such experiences I continue to advocate early operation.

The internist Umber is opposed to early operation in the presence of acute hemorrhage and cites a 57 year old woman with an ulcer penetrating to the liver and the pancreas which was responsible for a grave hemorrhage. In view of the fact that the general condition of the patient was poor and that she had only 30 per cent hemoglobin and 1,500,000 erythrocytes, the surgeon declined an early operation. A temporary cessation of bleeding followed a blood transfusion but the hemorrhage recurred on the seventh day and on the eleventh day the hemoglobin contents were only 19 per cent; pulse, 160; patient, unconscious. An operation was decided upon as a last resort but the patient expired in course of the preliminary blood transfusion. The autopsy showed a large gastric ulcer penetrating into the liver and the pancreas and an erosion of 2 large arteries. Umber concludes that the surgeon was justified in refusing to perform an early operation as recommended by me because such procedure undoubtedly would have stopped the fatal outcome. Based on my experience I believe that this case demonstrates the dangers of delay. If early operation under local anesthesia is performed in such a case and is preceded by blood transfusion and if according to Reschke's suggestion a large amount of blood, e.g., 1500 cubic centimeters of blood be used, it would be expected that the hemorrhage would be stopped as successfully as in the 6 cases in which I operated and in which erosion of the pancreaticoduodenal artery had taken place. After prolonged anemia has damaged all the organs including the brain, no results can be expected from operation, no matter how much blood has been transfused.

The results of late operation are relatively poor even if direct hemostasis can be accomplished. Of 7 cases in which gastro-enterostomy was performed 3 patients died. Such poor results are due to the continuation of

the bleeding from the penetrating ulcer. Even direct hemostasis is frequently unsuccessful because no recession of the degenerative changes in the internal organs caused by the anemia can be expected.

In 4 instances the ulcer was excised and 2 patients died from anemia. Of 63 resections 17, or 26.9 per cent, died. It must be stated that in 4 instances death was not attributable to the hemorrhage or to the operation; 1 patient died from a recurrence of dysentery, 1 from uremia, 1 from septicemia following gangrenous appendicitis, and 1 from diabetic coma. In 2 cases perforation of the ulcer and peritonitis developed; such complications could have been avoided by early operation. When these 6 cases were deducted, the mortality still remained as high as 19.2 per cent. In the majority of the fatal cases the grave damage caused by anemia was responsible for death. The operation revealed erosion of a large artery outside of the stomach wall. The majority of the fatal cases were observed before 1924 when a blood transfusion was not yet used. It is questionable, however, whether blood transfusion could have saved those cases.

Poor results after delayed operation do not militate against the operative procedure because sometimes the patient can be saved.

Umber reports a 23 year old patient who in spite of 5 blood transfusions had recurrent hemorrhages until the hemoglobin fell to 26 per cent and the red count did not exceed 1,200,000; on the twenty-eighth day of bleeding the patient was unconscious and delirious and was operated on as Umber advised. At operation a duodenal ulcer penetrating into the pancreas, with an erosion of the pancreaticoduodenal artery, was found. One blood transfusion was given before and two after the operation which consisted of a Billroth II gastric resection. The patient recovered.

In my series of cases there were 6 among the late operations in which in spite of the fact that the pancreaticoduodenal artery was eroded, gastric resection produced a cure.

The relatively poor results after delayed operation are still superior to those of purely conservative treatment: according to Chiesman, the mortality in cases in which the bleeding lasted more than 2 days was not 3 per cent but 74 per cent. Gordon-Taylor, of the Middlesex Hospital, reports even a mortality of 76 per cent with medical treatment. Therefore I believe that no surgeon is privileged to refuse operation to a patient unsuccessfully treated by an internist.

The type of anesthesia used is of greatest importance in operations for acute hemorrhage, especially in delayed operations. Ether anesthesia must be avoided under all circumstances because, according to Crile's investigations reported in his book entitled *Surgical Shock and Shockless Operations Through Anoci-Association*, ether produces grave damage to the parenchymatous organs, especially the liver, kidneys, and brain. While normal organs easily overcome such harmful effects, organs damaged by anemia may be fatally affected. For these reasons I perform all operations for acute hemorrhage under local anesthesia, avoiding if possible splanchnic anesthesia because the latter has a depressor effect. Careful regional anesthesia of the abdominal wall is followed by an anesthesia of the mesentery, using a 0.25 per cent novocain solution. Great caution should be exercised in the use of morphine or pantopon before or after the operation, because even the usual doses may produce a paralysis of the respiratory center damaged by anemia, as seen by the author in 2 cases. If morphine is desired, 0.01 to 0.015 of the drug combined with 0.00025 atropine is given before the operation. In the presence of grave collapse repeated coramin injections are given in the course of the operation; in addition to it inhalations of ether are given for stimulating purposes, provided no bronchitis is present. For this purpose the total amount of ether given with the open method does not exceed 10 to 20 cubic centimeters. Great attention must be paid to after-treatment, especially in old people; deep respiration and good expectoration are necessary to avoid a retention pneumonia, if a bronchitis is present.

While a large percentage of conservatively treated patients remains uncured and the patients must be operated on later, at least 90 per cent can be relieved of all their symp-

toms after resection of two-thirds of the stomach. In my material all 114 patients were permanently cured by resection.

The surgical treatment of an acute gastric hemorrhage requires sufficient experience not only in gastric surgery but also in the evaluation of the case. Therefore, such operations should be performed in large hospitals, not by young assistants but by the head of the department or one of his older associates, in order to keep the mortality as low as possible, without refusing operation to anyone who shows an absolute indication.

Acute profuse gastric hemorrhage should not be confused with grave secondary anemia following repeated gastric hemorrhages; the latter has been considered for a long time as an absolute indication for operation. Such hemorrhages are not seen so often as they used to be. I operated upon 54 patients with secondary anemia; the number of erythrocytes ranged from 1,500,000 to 2,500,000 and the hemoglobin contents from 20 to 30 per cent. Before the World War I used only gastro-enterostomy. Of 5 cases, 1 expired on the sixth day from an erosion of the splenic artery. After the War resection has been used almost exclusively. This operation has given us good results even without transfusion and it has always been performed under local anesthesia. Of 49 resections death occurred in 2, i.e., 4 per cent.

Gordon-Taylor closes his paper on the treatment of acute gastric hemorrhages as follows: "Finsterer's first 48 hours is still the optimum period for surgical attack in hematemesis and the golden age of gastric surgery will have been attained only when all cases of hemorrhage from chronic ulcer come to operation within that space of time."

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MALIGNANT TUMORS OF THE SMALL INTESTINE

A Study of Their Incidence and Diagnostic Characteristics

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THE subject of intestinal malignancies is always of vital interest: malignancies of the colon and rectum because of their great frequency; malignancies of the small intestine because of their rarity. Ewing estimates the comparative incidence of malignancy in the large and small intestines to be 97.5 per cent and 2.5 per cent, respectively. The incidence of intestinal carcinoma in order of frequency according to location is: rectum, cecum and appendix, sigmoid, colon, and small intestine. Kaufmann and others state that over 60 per cent of intestinal malignancies arise in the rectum. In 1930, Schofield found only 36 cases of small intestinal carcinoma in a total of 140,000 autopsies. Similarly, from a series of more than 350,000 autopsies Eger reported in 1933 an incidence of 30 duodenal carcinomas per 100,000 patients.

Of the malignant tumors of the small intestine, carcinomas appear to outnumber the sarcomas. In a review of the literature, one is impressed by the tendency of authors to classify and describe only carcinomas and to place sarcomas with lymphomatous tumors in a general group of other malignant tumors of the small intestine. The comparative incidence of the two groups of malignant neoplasms has seldom been recorded. However, Brill from 17,000 autopsies at Guy's Hospital, London, collected 10 cases and of these 4 were carcinoma and 6 sarcoma. In Raiford's series of 34 cases, there were 20 carcinomas and 14 sarcomas. He concludes that the tumors of the small intestine rank in order of frequency: (1) carcinomas, (2) adenomas and sarcomas, (3) lipomas and tumors of chronic inflammatory origin; and finally, the most uncommon, fibromas, myomas, carcinoids, hemangiomas, cysts, and endotheliomas.

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It is interesting to note the incidence of malignancies of the small intestine in the pathological material of the New England Deaconess and Palmer Memorial Hospitals during the period from January, 1927, to January, 1939. During this 12 year period 918 primary malignancies were found in a total of 1,456 postmortem examinations. In brief, in 63.0 per cent of autopsies malignancy presented. There were approximately 41,000 surgical specimens and in 20 per cent of these the primary diagnosis was malignancy. A review of the same series shows only 10 cases that came to autopsy with small intestinal malignancy, or an incidence for all autopsies of 0.69 per cent and for all malignancies seen at postmortem examination of 1.09 per cent. The surgical material shows 12 cases, an incidence for small intestinal malignancy of 0.03 per cent of the total specimens and 0.15 per cent of total malignancies removed surgically. Since a large part of the service of the New England Deaconess and Palmer Memorial Hospitals is devoted to the treatment of cancer, these findings are not comparable with those given by Eger and others (15, 16) from several general hospital records.

The observed location of the tumors in these 22 patients is in disagreement with the statements of Ewing and Bland-Sutton that the jejunum is least frequently the site of malignant growth and that the nearer one approaches the beginning and end of the small intestine, the more frequently one finds cancer; for, of the total, 12 occurred in the jejunum, 7 in the ileum, and 3 in the duodenum. However, it is only fair to add that with 22 cases there is considerable chance error of distribution to account for this difference. In 22 cases of small intestinal malignancy, Judd similarly found 11 in the jejunum, 6 in the ileum, and 5 in the duodenum. From a small series of cases in the literature, Deaver and

TABLE I.—LOCATION OF MALIGNANCY IN SMALL INTESTINE

	Duodenum	Jejunum	Ileum	Total
Nothnagel series	7	0	11	18
Judd series	5	11	6	22
Raiford series	8	7	16	31
Johnson series	0	2	1	3
Bevan*	0	5	0	5
Lichty*	6	0	0	6
McGuire*	4	0	0	4
Baillot, Davis, Deaver, Head, Herman, Jefferson, Kendall, Lynch, Macewen, Portis, Primrose, Traylor, Vicker*	18	2	3	23
Author's series	3	12	7	22
Total	51	39	44	134

*Quoted by E. D. Clark.

TABLE II.—CLASSIFICATION OF MALIGNANCIES IN SMALL INTESTINE (AUTHOR'S SERIES)

Classification	Duodenum		Jejunum		Ileum		Total
	Autopsied	Surgical	Autopsied	Surgical	Autopsied	Surgical	
Adenocarcinoma	2	0	2*	4	1	1	10
Carcinoma simplex	0	0	0	1*	0	0	1
Malignant adenoma	1	0	1	3*	0	0	5
Leiomyosarcoma	0	0	1**	0	2	3	6
Total	3	0	4	8	3	4	22

*These figures represent 1 adenocarcinoma, 1 carcinoma simplex, and 1 malignant adenoma previously reported by Dr. Everett D. Kiefer.
**These figures represent 1 leiomyosarcoma previously reported by Dr. R. B. Cattell.

Ravdin found a relative distribution of malignancy of the duodenum and that of jejunum and ileum as 47.8 per cent to 52.2 per cent, and 66 per cent of those in the duodenum occurred in the second portion. On analysis of 134 cases, including the author's series, of small intestinal malignancy reported in the literature (Table I), the distribution according to location follows: duodenum, 51 cases; jejunum, 39 cases; ileum, 44 cases. It seems apparent, therefore, that the duodenum and ileum are somewhat more prone to develop malignant growths than the jejunum. However, of the small intestinal cancers, cancer of the jejunum is not rare.

In the author's series, the total of 22 cases represents 16 primary carcinomas and 6 primary sarcomas, 2 cases of primary lymphoblastoma being excluded. An impression that sarcoma occurs most frequently in the terminal jejunum and ileum, and carcinoma usually in the duodenum and jejunum is borne out by the finding of 5 of the 6 sarcomas in the ileum and 14 of the 16 carcinomas in the duodenum and jejunum. One sarcoma occurred in the lower jejunum and 2 carcinomas in the ileum. The location of malignancies in the author's series (Table II) corresponds to the observations of Dewis and Morse and of Kiefer that the duodenum and jejunum are more likely to undergo carcinomatous change than the ileum, and that sarcoma occurs more frequently in the ileum than in any other part of the small intestine. It is generally held that sarcomas occur more frequently in the ileum due to the greater abundance of lymphoid tissue in this segment of the intestine. However, among the cases of sarcoma recorded in the literature there is no record of histological classification of the sarcoma. The 1 case of sarcoma reported by Cattell and the 6 cases reported by the author all prove to be the leiomyosarcoma type.

Two patients in this series presented multiple malignancies; in addition, a third patient showed a carcinoid of the appendix in association with a leiomyosarcoma of the ileum.

Calculated at the time of autopsy or operation the average age incidence for this series was 54 years, for the carcinoma group 56 years, and for the sarcoma group 47 years. The youngest patient, presenting at autopsy a leiomyosarcoma of the ileum, was a male of 31 years. There were 9 males and 13 females.

Although malignancies of the small intestine may occur as part of a local or generalized polyposis, Ewing states that they are seen usually as a localized growth. In none of the patients of this group who were treated surgically or who came to autopsy was there an associated polyposis recorded. Like those in the colon, these tumors tend to be stenosing or polypoid in form, the malignant adenomas and mucinous adenocarcinomas assuming the polypoid form, growing extensively into the bowel lumen and with delayed surface ulceration often producing obstruction. The scir-

rhous carcinomas, or carcinoma simplex, and sarcomas tend to be annular, producing obstruction by constriction of the intestinal lumen. Because of the more expansive nature of the sarcomas, the mesenteric nodes are reported by Raiford to be more frequently involved by tumor. Several small series of cases of small intestinal malignancy that came to autopsy show metastases present in one-quarter to one-third of the patients and involve chiefly the mesentery, liver, lungs, and peritoneum. Craig, reporting a series of 26 cases from the Mayo Clinic, demonstrated that 36 per cent of the patients showed mesenteric lymph node involvement and according to him neither the size of the growth nor the duration of the symptoms is a reliable index of lymphatic involvement. Of the author's series, 7 patients presented metastases. Three of the 10 patients who came to autopsy showed metastases to the mesenteric nodes and viscera. Three surgical specimens showed metastases in the adjacent mesenteric lymph nodes. A seventh patient with adenocarcinoma and negative lymph nodes showed generalized carcinomatosis 2 years later at re-exploration.

The clinical picture of small intestinal malignancy is usually not clear-cut and varies widely. In general, Schofield, Brill, Judd, Deaver and Ravdin, and others, conclude that primary carcinoma of the duodenum arising in the first and third portions usually obstructs the bowel. If the tumor occurs in the first part of the duodenum, symptoms are more often acute in onset and simulate pyloric carcinoma with obstruction. Primary carcinoma of the second portion, usually arising in or about the papilla of Vater, seldom produces intestinal obstruction. Biliary obstruction with resultant painless jaundice, clay-colored stools, choluria, and associated constitutional complaints, is the train of symptoms most often seen. However, a few patients with peri-ampullary carcinoma first present themselves with intestinal obstruction alone. In connection with obstructing malignancies of the third portion of the duodenum, Deaver calls attention to the profuse vomitus containing bile and the pancreatic enzyme, trypsin.

Raiford, Johnson, and others cite malignancy of the lower small intestine as producing symptoms most commonly of partial or complete obstruction due either to pressure and gradual encroachment of the lumen, or to intussusception. There is a small group of tumors, growing away from the intestinal lumen into the free peritoneal cavity, producing no mechanical obstruction and merely the constitutional symptoms of malaise, loss of weight, anemia, and the like. Malignant tumors of the jejunum and ileum are more prone to produce intestinal intussusception. This occurred in 23 per cent of the tumors of the jejunum reported by Raiford and in 30 per cent of cases reported by Staemmler. The history of sudden onset of sharp pain and vomiting followed by bloody mucus in the stool, abdominal distention, and shock is the usual picture of intussusception associated with tumor. Raiford states that palpation of a mass is the most constant and reliable of the physical signs.

Although absence of free hydrochloric acid in gastric content and presence of occult blood in the stools are mentioned as frequent findings, these are not constant and obviously not specific for the diagnosis of small intestinal malignancy. Similarly, pain, nausea, vomiting, distention, palpable mass, and anemia may occur with any intestinal malignancy. The roentgenogram is generally recognized as the best positive means of diagnosis but is not infallible *per se*. Mills, in his classical paper on small intestinal states, concludes that, "any organic process involving the small intestinal wall, either primarily or secondarily, will modify the x-ray shadow of the content of the part involved and thus render direct diagnostic evidence of its presence." However, the roentgenologist is seldom able to diagnose more than the presence of an organic lesion in the small intestine and in about half of the proved cases x-ray evidence was negative. Important roentgenographic evidence supporting the diagnosis is: (1) dilatation of the stomach or small intestine with barium retention; (2) filling defect in the small intestine; (3) point of intestinal constriction as in partial obstruction; and (4) dense shadow. The amount of gas, fluid, and distention seen

roentgenographically will depend on the level of the obstructing lesion and the degree of obstruction.

Lesions simulating carcinoma of the small intestine roentgenographically are: ulcer, polyp, benign tumors, diverticulum, tumors and cysts of the head of the pancreas, pancreatitis and retroperitoneal inflammatory or neoplastic masses. If a defect is present, its character may be of help. A sharp, marginal outline with the defect suggests a tumor within the intestinal lumen while a wide-sweeping defect is most often produced by the pressure of extrinsic pathology.[1]

ANALYSIS OF SERIES

In the author's series of 22 cases of malignant tumors of the small intestine, there were 3 patients with duodenal carcinoma arising at the papilla of Vater presenting, in common, jaundice. One of these patients, presenting in addition recurrent attacks of colic-like pain, at autopsy showed stones impacted in the common bile duct just proximal to the tumor, and it is tempting to speculate whether the duct stones or the cancer were the primary disease process. If it could be supposed that the stones antedated the formation of the cancer by several years, there are those who would cite repeated trauma as an important etiological factor in the origin of the malignancy. Two other patients presented typical histories of progressive painless jaundice of an obstructive type with clay-colored stools and choluria.

Most cases of painless jaundice are due to an infectious or degenerative process of the liver or to carcinoma of the head of the pancreas. A valuable diagnostic measure for obstructive painless jaundice is Courvoisier's law. In the presence of painless jaundice a distended gall bladder palpable through the abdominal wall points to an obstruction due to cancer at 1 of 3 sites: head of the pancreas, papilla of Vater, or common duct distal to the point where the cystic duct enters the common duct.

The outstanding complaints presented by the 19 patients with jejunal and ileac cancers were those of intestinal obstruction of an acute or chronic nature. Thirteen of the 19 patients entered the hospital with the chief complaint of abdominal pain and vomiting. In these patients the pain varied in intensity from the vague intermittent abdominal distress to the severe persistent abdominal colic. Abdominal distention, flatulence, and eructation were often associated with the bouts of abdominal pain. It is significant that in no patient was there a remission of vomiting after onset. The duration of symptoms varied from several hours, as seen in acute intestinal obstruction, up to 2 years.

Of the 19 patients there were 9 presenting generalized complaints of weakness, fever, loss of weight, and anemia. In 3 patients these were the only presenting symptoms. It is significant that loss of weight was seen in only 4 of the 19 patients, for one would expect, with chronic intestinal obstruction and toxemia as seen in the majority of these patients, many more would have complained of weight loss.

Of note is the finding of rectal complaints in 7 of these patients. The symptoms included constipation, gross blood, diarrhea, and pencil-like stools. Change of bowel habit was a presenting complaint in 3 of these patients and proved of great aid in localizing pathology in the gastro-intestinal tract. The change of bowel habit or rectal bleeding, as seen with cancer of the rectum, colon, and stomach is well known. Melena is cited by all observers as being an important finding with small intestinal malignancy. In 15 of our 22 cases there was no history of gross bleeding and no studies for microscopic blood. In 7 patients there was evidence of bleeding; 4 patients presented a history of gross bleeding or tarry stools and 3 patients studied for occult blood gave strongly positive reactions. It is, therefore, to be recommended that any patient with change of bowel habit or melena in whom studies have eliminated any pathology in the esophagus, stomach, colon, and rectum, should be thoroughly investigated to rule out malignancy of the small intestine.

In 12 of the 22 patients an abdominal mass was palpable on physical examination—in 1 of the 3 duodenal cases, in 5 of the 12 jejunal cases and in 6 of the 7 ileac cases. The experi-

[1]Personal communication—Dr. Joseph H. Marks.

ence with this group of cases does not coincide with that of Raiford that in the malignancies of the jejunum and ileum intussusception of the carcinomatous mass occurs in about one-fourth of the patients, for of the total, none showed intussusception at the time of operation.

The clinical x-ray findings in this series confirm the statement of others that a careful gastro-intestinal series with special study of the small intestines is of great aid in making a presumptive diagnosis of small intestinal malignancy. Twelve of the 22 patients received a gastro-intestinal series previous to operation. In 8 of the patients there were positive findings of either intestinal dilatation with barium retention (6 cases) or filling defect (2 cases). In the 2 patients with filling defect, roentgenographic diagnoses of carcinoma of the pancreas and diverticulum of the duodenum were made. When one realizes that in one case of malignant adenoma of the duodenum the appearance of the tumor by the roentgenological, surgical, and gross pathological examinations suggested carcinoma of the pancreas, the difficulty of exact diagnosis of duodenal malignancy becomes apparent. The very small size of the lesion in another patient with a duodenal malignancy was undoubtedly the reason for the poor visualization in the gastro-intestinal series. However, that there was a defect in the second portion of the duodenum is attested by the x-ray report of a diverticulum which was not demonstrated at autopsy. Soper, in 1929, emphasized the importance of differentiating diverticulum and carcinoma by the character of the x-ray defect and the presence of occult blood in the stool.

In 3 of the 12 patients the x-ray studies proved negative. In these patients there was no special barium series of the small intestine, and it is apparent from the surgical and pathological findings that if such studies had been carried out the roentgenological diagnosis would probably have proved positive. In one patient the initial gastro-intestinal series showed a questionable dilatation of loops of the small intestine and 2 re-examinations showed negative series. It is apparent that the 4 patients admitted to the hospital with acute intestinal obstruction received no primary barium studies and are included among the 10 in which such studies were not done.

In this series we were not able to make any observation on the incidence of achlorhydria associated with small intestinal malignancy. In 2 of the patients a gastric analysis was done and in both free acid was present.

In 13 of the 22 patients radical surgery for the resection of the tumor was performed and the intestine re-established either by a side-to-side, an end-to-end, or side-to-end anastomosis. Palliative surgery was done in 6 patients. In 2 of the duodenal cases, a cholecystojejunostomy and choledochostomy were performed for relief of biliary obstruction, and no attempt was made to resect the malignancies. The experience of the Mayo Clinic (5) and others is that lesions of the duodenum are very difficult technically to resect and that usually when they become manifest they are so far advanced that ablation is impossible. In 3 patients short-circuiting entero-enterostomies were performed because of extensive local involvement or distant metastases. In another patient the tumor was surrounded by a large abscessed cavity which precluded surgical resection. In 3 patients no surgery was performed.

In an analysis of the end-results as seen in the 22 cases of small intestinal malignancy, one finds that 13 patients received radical resection, an operability rate of 59.1 per cent. There were 4 deaths in 13 resections or an operative mortality for resections of 30.8 per cent. Of the resected patients 1 each died of generalized peritonitis, uremia, intestinal obstruction due to intussusception, and in 1 case no cause of death was found at autopsy. Among the group of 9 survivals there were 5 patients who died from 5 months up to 8 years later. There were 4 cases in which death could be attributed directly to recurrence and the longest survival was 2 years. The fifth patient lived 8 years and at postmortem examination the cause of death was proved acute intestinal obstruction with no evidence of recurrence. In addition there were 6 patients receiving palliative surgery, 5 of whom died during the hospital stay due to intestinal obstruction or generalized peritonitis. One

of the 6 patients receiving palliative surgery was discharged from the hospital improved but because of the inoperability of the cancer is considered dead. Of the total 19 operative cases there were 9 deaths in the hospital, or a total mortality for all surgery of 47.4 per cent.

Thus, of the total, there are 18 known dead and 3 known and 1 possible living. Among the known living there is one 11 years with no recurrence, one 3 years with no recurrence and one 3 months. A fourth possible survival was living and well 1 year after operation but has been lost to follow-up since 1935.

In the final evaluation, a careful history and physical examination may give some clue; presence of occult blood in the stool is important supporting evidence; however, the main proof for the diagnosis rests with the surgeon or roentgenologist. Lacking such signs of small intestinal obstruction or filling defect, the roentgenologist is unable to establish the diagnosis. Therefore, the clinical diagnosis has heretofore been made most often at the time of exploratory laparotomy. Many of the small intestinal malignancies, especially those of the jejunum and ileum are amenable to surgical resection. Craig, commenting on the end-results seen at the Mayo Clinic, states that the operative prognosis and longevity are most favorable with lesions of the jejunum. It is, therefore, to be hoped that both roentgenologist and surgeon will be encouraged to look for these tumors so that a material increase will be made in the proportion of cases in which diagnosis is made or the lesion is suspected before operation and in which operation is performed.

SUMMARY

1. This report contains an analysis of 22 cases of small intestinal malignancy, of which there were 3 duodenal, 12 jejunal, and 7 ileac malignancies. Of the total there were 16 carcinomas and 6 sarcomas.

2. An analysis of 134 cases of malignancies of the small intestine, including the author's series, shows malignant tumors of the duodenum and ileum to occur slightly more frequently than malignant tumors of the jejunum.

3. Of the malignancies of the small intestine carcinoma occurs most frequently in the duodenum and jejunum, and sarcoma in the ileum.

4. The clinical picture of small intestinal carcinoma is variable. Biliary obstruction is most often seen with malignancies about the papilla of Vater and intestinal obstruction with malignancies of the lower duodenum, jejunum, and ileum. Gross bleeding or occult blood in the stools is a frequent finding in malignancy of the small intestine.

5. Any patient presenting signs of intestinal obstruction, change of bowel habit or melena, in whom studies have eliminated any pathology in the esophagus, stomach, colon, or rectum, should have very careful studies to eliminate the presence of malignancy of the small intestine.

6. Roentgenological study with a special barium series of the small intestine is generally recognized as the best positive means of diagnosis but, *per se*, is not infallible.

7. In this series of 22 cases there were 4 operative deaths of the total 13 radical resections, or an operative mortality of 30.8 per cent. Of the total of 19 patients treated by surgery there were 9 deaths or an operative mortality for all surgery of 47.4 per cent.

8. Of the 22 patients, 18 are known dead. Of the survivals, 3 patients are living and well with no recurrence for periods of 11 years, 3 years, and less than 1 year. A fourth possible survival was living with no recurrence for 1 year and has been lost to follow-up.

9. The surgeon and roentgenologist are encouraged to look for malignancies of the small intestine so that the proportion of cases diagnosed early and cured may be increased.

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OXYGEN THERAPY IN REACTIONS FOLLOWING BARBITURATE ANESTHESIA AND CISTERNAL INTERVENTION

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CEREBROSPINAL intervention is followed by a number of reactions which are of prime importance to the neurosurgeon and internist. These reactions were first brought to our attention during an investigation of Pieron's hypnotoxin theory of sleep (6). Elevation of intracisternal pressure and body temperature followed the slow aseptic cisternal withdrawal and replacement of cerebrospinal fluid in normal dogs. Reactions of a similar magnitude occurred in unanesthetized dogs and in dogs anesthetized with pentobarbital.

The literature contains a few observations of the intracranial pressure reactions produced by barbiturate anesthesia and by lumbar and cisternal punctures, but no extensive investigation of these reactions can be found. Bullock, Gregerson, and Kinney report elevations in intracisternal pressure of 40 millimeters cerebrospinal fluid over a 12 hour period in dogs under amytal anesthesia. Elevations in cerebrospinal fluid pressure following lumbar puncture and withdrawal of fluid in man has been observed (11, 14, 15). Cases of aseptic meningitis in humans with elevations of body temperature and cerebrospinal fluid cell counts following lumbar and suboccipital puncture have been reported by a number of observers (5, 9, 16, 17). Kasahara, Takaiski, and Tamada have shown in an experimental study upon rabbits and dogs that cisternal replacement of 0.5 to 1 cubic centimeter of cerebrospinal fluid with air is followed by a cellular pleocytosis up to 2,013 cells per cubic centimeter of cerebrospinal fluid. There also occurred an increase in spinal fluid protein. The pleocytosis reached a maximum 3 to 6 hours after the procedure and the cerebrospinal fluid did not return to normal until after 3 to 7 days. Schwab and von Storch found leucocytic pleocytosis and erythrocytes in the cerebrospinal fluid of humans after more profound cerebrospinal intervention associated with encephalography. Maximum cellular reaction occurred in 6 hours and usually disappeared in 48 hours but occasionally persisted for 6 to 8 days.

This work presents the results of an investigation of the reaction following barbiturate anesthesia and aseptic cisternal intervention

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TABLE I.—EFFECT OF NASAL OXYGEN UPON REACTIONS TO BARBITURATES AND CISTERNAL INTERVENTION—AVERAGE 6 DOGS EACH COLUMN

	Anesthetic						Cisternal withdrawal and replacement of 8 c.cm. of cerebrospinal fluid											
							Pentobarbital						Amytal					
	Pentobarbital			Amytal			Control			Oxygen			Control			Oxygen		
	C.S.F. press.	R.T.	Resp.	C.S.F. press.	R.T.	Resp.	C.S.F. press.	R.T.	Resp.	C.S.F. press.	R.T.	Resp.	C.S.F. press.	R.T.	Resp.	C.S.F. press.	R.T.	Resp.
Basal	90	102.2	20	99	101.8	17	106	100.1	18	95	102.4	21	107	101.3	19	106	101.7	18
1 hour	93	102.2	21	104	101.8	17	141	100.1	19	125	101.2	20	154	101.9	21	148	101.2	18
2 hours	93	102.3	22	109	101.9	17	174	100.0	20	141	100.3	19	209	102.8	23	169	100.7	17
3 hours	104	102.2	22	116	102.2	18	211	102.1	23	146	100.4	19	252	103.7	25	160	99.3	17
4 hours	113	102.4	22	124	102.3	18	230	102.9	22	162	100.2	25	263	104.3	26	146	99.1	17
5 hours	111	102.5	22	127	102.5	18	223	103.6	23	164	100.6	24	226	104.5	29	145	98.5	17
6 hours	108	102.9	22	128	102.5	18	210	103.4	24	142	101.0	26	199	105.0	34	136	98.5	17
7 hours	113	103.0	22	127	102.5	18	201	103.9	27	134	101.1	26	188	105.4	36	126	98.6	17
8 hours	102	103.1	22	126	102.5	18	198	104.0	27	121	101.4	26	169	105.5	38	135	99.7	17

C.S.F. press.—Cerebrospinal fluid pressure.
R.T.—Rectal temperature.
Resp.—Respiration.

in the dog and of the rôle played by anoxemia and of the ameliorating effects of oxygen therapy upon these reactions.

A. THE EFFECT OF BARBITURATE ANESTHESIA UPON INTRACISTERNAL PRESSURE, RECTAL TEMPERATURE, SPINAL FLUID PROTEIN AND CELLS, AND UPON BLOOD ARTERIAL OXYGEN SATURATION

Procedure. Continuous intracisternal cerebrospinal fluid pressures were recorded in 6 dogs under sodium pentobarbital and in 6 dogs under sodium amytal anesthesia. Both barbiturates were given intravenously in doses of 30 to 35 milligrams per kilogram of body weight. In order to maintain the anesthesia each dog received an additional intramuscular injection of 120 milligrams 3 and 6 hours after the onset of the experiment.

Surgical asepsis was maintained: all apparatus was autoclaved for 30 minutes under 20 pounds pressure. The back of the dog's head and neck was cleanly shaved, 7 per cent iodine and 70 per cent alcohol was applied, and the animal was draped with sterile towels.

A twenty-gauge needle was then inserted into the cisterna magna and the cerebrospinal fluid was permitted to ascend into the capillary manometer attached by means of a "T" tube. This caused a displacement of only about 1 cubic centimeter of cerebrospinal fluid. The cerebrospinal fluid pressure, rectal temperature, and respiratory rate were recorded at hourly intervals for 8 hours. Basal conditions of water balance were maintained by depriving the dogs of water for 12 hours before they were used.

In another series of dogs total protein and total cell count determinations were performed upon cerebrospinal fluid withdrawn from the cisterna magna of 6 dogs after 8 hours of pentobarbital anesthesia and amytal anesthesia in 6 additional dogs. Total spinal fluid protein was estimated turbidimetrically after precipitating with sulfosalicylic acid reagent. This method has been used by Denis and Ayer with satisfactory results and has been found to check with the Kjeldahl procedure according to Mattice.

In 3 dogs of each of the latter series blood samples were obtained under oil from the exposed carotid artery of amytal dogs only at ½, 4, and 7 hour intervals after the administration of the anesthetic. The samples were analyzed for oxygen content and oxygen capacity according to the method of Van Slyke.

Results. The effects of barbiturate anesthesia are averaged in Table I and graphed in

TABLE II.—CEREBROSPINAL FLUID CELLS AND PROTEIN IN THE DOG

Dog	Normal—unanesthetized		Pentobarbital						Amytal	
			Alone		Cisternal intervention		Cisternal intervention and nasal oxygen		Alone	
	Cells	Protein	Cells	Protein	Cells	Protein	Cells	Protein	Cells	Protein
1	10	20	10	20	1800	120	800	65	4	10
2	17	25	8	10	660	90	560	60	3	10
3	5	20	3	20	1800	130	187	20	12	15
4	7	20	2	10	1140	140	428	45	6	20
5	5	30	8	10	1104	90	1080	90	5	15
6	3	10	16	15	1260	65	986	60	10	20
Av.	7	20	7	14	1294	122	672	53	6	15

Figure 1. Pentobarbital anesthesia in 6 dogs caused an average elevation of cerebrospinal fluid pressure of 23 millimeters over a period of 8 hours. Amytal anesthesia in 6 dogs caused an average elevation of 29 millimeters. There was a slight associated elevation of rectal temperature, namely, 0.9 degree F. in those dogs given pentobarbital and 0.7 degree F. in dogs given amytal, with no significant alterations of the respiratory rate.

No significant alteration of cerebrospinal fluid cells and protein was observed after 8 hours of pentobarbital and amytal anesthesia (Table II).

Table III shows that barbiturate anesthesia produced a marked depression of arterial blood oxygen saturation from a normal average in 3 dogs of 93.3 per cent to 68.8 per cent with pentobarbital and 83.6 per cent with amytal ½ hour after its administration. Four hours later the oxygen saturation under pentobarbital rose to 84.6 per cent while under amytal it fell to 79.1 per cent and in the latter case rose to 92.5 per cent after 7 hours.

B. REACTIONS TO ASEPTIC CISTERNAL WITHDRAWAL AND REPLACEMENT OF 8 CUBIC CENTIMETERS OF CEREBROSPINAL FLUID IN DOGS UNDER BARBITAL ANESTHESIA

Procedure. Procedure A was repeated upon another group of 6 dogs under pentobarbital and 6 dogs under amytal anesthesia. After the initial intracisternal pressure was measured, 8 cubic centimeters of cerebrospinal fluid was slowly aspirated and replaced. This procedure usually took 5 to 6 minutes and resulted in no loss of cerebrospinal fluid.

Protein and cell count determinations were performed upon samples of cerebrospinal fluid obtained 8 hours after slow aseptic cisternal aspiration and replacement of 8 cubic centimeters of cerebrospinal fluid in another group of 6 pentobarbitalized dogs. In 3 of these dogs blood samples for oxygen analysis were obtained ½ hour and 4 hours after the cisternal intervention.

Results. Aseptic cisternal withdrawal and replacement of 8 cubic centimeters of cerebrospinal fluid in the anesthetized dog resulted in a progressive increase in intracisternal pressure (Table I). With 6 dogs under pentobarbital the average increase in pressure above normal was 124 millimeters (Fig. 2) and under amytal the pressure of 6 dogs rose 156 millimeters of cerebrospinal fluid above normal (Fig. 3). The peak of elevation of cere-

TABLE III.—SUMMARY OF BLOOD GAS ANALYSIS—CAROTID ARTERY—AVERAGE 3 DOGS EACH COLUMN

Blood gas analysis	Normal unanesthetized	Pentobarbital						Amytal		
		Alone		Cisternal intervention		Cisternal intervention and nasal oxygen		Alone Femoral artery		
		0.5 hour	4 hours	0.5 hour	4 hours	0.5 hour	4 hours	0.5 hour	4 hours	7 hours
Oxygen content	16.9	12.4	15.5	13.5	15.8	17.6	17.8	15.3	14.5	17.6
Oxygen capacity	18.2	18.4	18.4	18.0	18.0	18.5	18.5	18.4	18.4	18.4
Oxygen saturation	93.3	68.8	84.6	74.4	88.1	95.7	96.6	83.6	79.1	92.5
Carbon dioxide content	40.6	49.0	42.5	45.7	42.8	47.9	43.4			

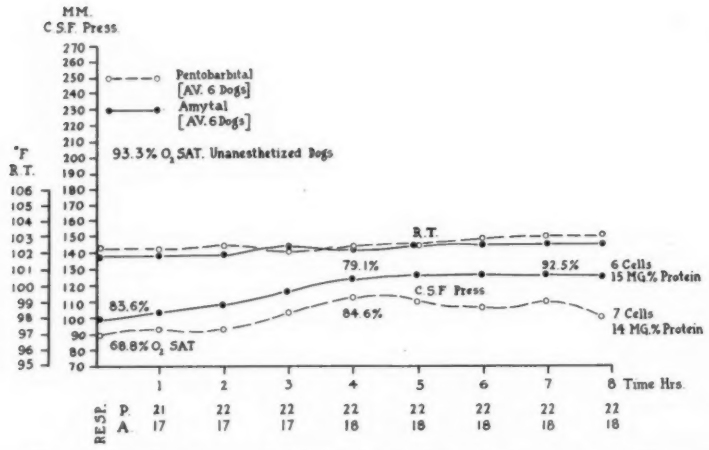

Fig. 1. Reactions to pentobarbital and amytal anesthesia—30 to 35 milligrams per kilogram intravenously.

brospinal fluid pressure occurred about 4 hours after the cisternal intervention following which the pressure decreased slowly but was still elevated 62 millimeters with pentobarbital and 92 millimeters with amytal above normal 8 hours after the intervention. There occurred a gradual elevation of rectal temperature above normal, 3.9 degrees F. with pentobarbital and 4.2 degrees F. with amytal, and the respiratory rates were increased 9 and 19 respirations per minute respectively.

Eight hours after the procedure there was a definite increase in the number of cells, or an average of 1,294, and an average total protein of 122 milligrams per cent in the cerebrospinal fluid (Table II). Arterial oxygen saturation was reduced to 74.4 per cent after ½ hour and 88.1 per cent in 4 hours. Dogs that were permitted to recover were normal the morning after they were used and showed no subsequent deleterious effects.

C. EFFECT OF NASAL OXYGEN THERAPY UPON THE REACTIONS FOLLOWING ASEPTIC CISTERNAL WITHDRAWAL AND REPLACEMENT OF 8 CUBIC CENTIMETERS OF CEREBROSPINAL FLUID

Procedure. Procedure B was repeated upon another series of 6 dogs under pentobarbital anesthesia. In addition each dog received 99.5 per cent oxygen by means of a nasal catheter at the rate of 10 liters per minute. This rate of flow produces an alveolar oxygen content of 50 to 55 per cent according to Barker, Parker, and Wassell.

Results. The results are averaged in Table I and graphed in Figures 2 and 3. The average elevation of cerebrospinal fluid pressure following cisternal intervention was only moderate in the dogs which received oxygen. The elevation above normal was 69 millimeters under pentobarbital and 54 millimeters under amytal anesthesia. Rectal temperatures fell and there was no significant alteration in respiratory rates. Analysis of the cerebrospinal fluid showed an average cell count of 672 and only 53 milligrams per cent of protein. Arterial blood oxygen saturation was elevated 95.7 per cent above normal in ½ hour and 96.6 per cent in 4 hours.

D. SPINAL FLUID CULTURES AFTER CISTERNAL WITHDRAWAL AND REPLACEMENT OF CEREBROSPINAL FLUID

Procedure. Two cubic centimeters of cerebrospinal fluid were withdrawn from each of 4 pentobarbitalized dogs immediatly after cisternal intervention and were cultured upon brain broth and subsequently upon blood agar plates.

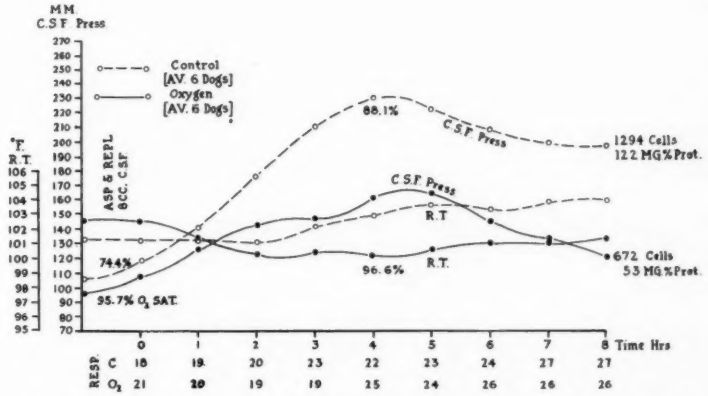

Fig. 2. Effect of nasal oxygen upon reactions to cisternal intervention in dogs under pentobarbital anesthesia.

Results. All 4 of the broth cultures were clear after 48 hours' incubation at 38 degrees. No colonies could be grown upon blood agar plates inoculated with the broth cultures. Failure to demonstrate organisms in the cerebrospinal fluid of the dogs following cisternal withdrawal and replacement of cerebrospinal fluid demonstrates that the reactions observed are aseptic. This is further borne out by the failure of any of the dogs permitted to recover to display any signs of meningitis or encephalitis.

OBSERVATIONS

Pentobarbital and amytal anesthesia produce a significant depression of oxygen saturation of arterial blood. Pentobarbital caused 68.8 per cent or the greatest depression of blood oxygen saturation ½ hour after its administration. Considerable recovery, or 84.6 per cent, occurred in 4 hours but this was still definitely below normal, or 93.3 per cent. Under amytal anesthesia the depression of blood oxygen saturation at the ½ hour interval was 84.6 per cent but at 4 hours it had dropped to 79.1 per cent. Amytal, therefore, did not produce such a severe anoxemia but it was more persistent than that produced with pentobartibal and was about normal or 92.5 per cent 7 hours after its administration. McClure, Hartman, Schnedorf, and Schelling have obtained similar depression of arterial oxygen saturation in dogs with dial, evipal, and amytal.

In addition to this depression of blood oxygen saturation there is evidence in the literature which indicates that barbiturates cause a direct inhibition of the respiration of brain tissue. Jowett reports depressions of 6 to 32 per cent in the oxidation of glucose, lactate, and pyruvic acid substrates by brain tissue slices when luminal or evipan are added. He employed the manometric method of Warburg. Employing the same technique, Hundhausen has reported a decrease in oxygen consumption by surviving cortical and brain stem tissues of rabbits anesthetized with luminal and evipal.

The anoxemia *per se* observed in our dogs did not produce a significant alteration in cerebrospinal fluid pressure or spinal fluid protein or cells. Over an 8 hour period the average pressure rose 23 millimeters under pentobarbital and 29 millimeters under amytal. The more prolonged anoxemia produced by amytal was associated with the slightly higher elevation of cerebrospinal fluid pressure. No significant alteration of rectal temperature and respiration occurred. The effect of repeated daily administrations of these barbiturates was not investigated.

Even mild cerebrospinal intervention as the slow aseptic withdrawal and replacement of 8 cubic centimeters of cerebrospinal fluid,

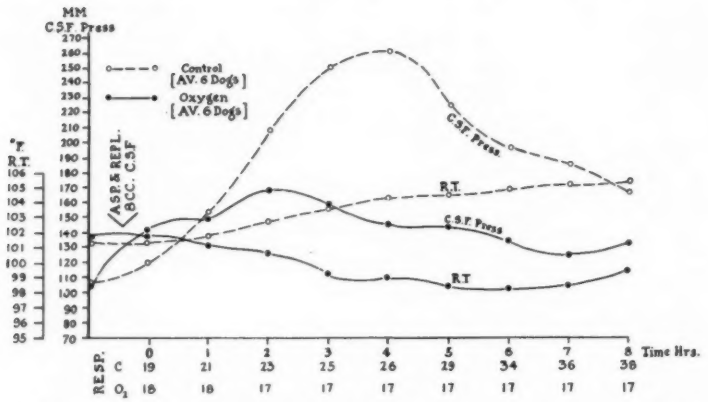

Fig. 3. Effect of nasal oxygen upon reactions to cisternal intervention in dogs under amytal anesthesia.

which is from 35 to 50 per cent of the total volume, is followed by profound reactions. Arterial blood oxygen saturation was 74.4 per cent at the ½ hour period and 88.1 per cent at the 4 hour period. These values are relatively higher than those with anesthesia alone, which are 68.6 per cent after ½ hour and 83.6 per cent after 4 hours, because of the hyperpnea which occurred together with an elevation of temperature in these dogs after cisternal intervention. The trauma of the slow aspiration and replacement of from 35 to 50 per cent of the total volume of cerebrospinal fluid, superimposed upon the capillaries and cells already subjected to anoxemia, resulted in their increased permeability so that protein, erythrocytes, and leucocytes appeared in the cerebrospinal fluid in increased amounts and there occurred a marked increase of 124 to 156 millimeters above normal in cerebrospinal fluid pressure. Landis reported that 4 minutes of anoxemia increased the capillary permeability in a frog's mesentery so that fluids filter through its walls at approximately 4 times the normal rate.

Administration of nasal oxygen restored the arterial oxygen saturation to values above normal, namely, 95.7 per cent in ½ hour and 96.6 per cent in 4 hours. The "tonic" effect of oxygen upon the capillaries in decreasing permeability is shown by the smaller number of cells and decreased quantity of protein occurring in the cerebrospinal fluid of the dogs which received oxygen. In addition, the cerebrospinal pressures did not rise so high above normal in these dogs but only to 69.63 millimeters and returned to a lower level sooner than in the dogs which did not receive oxygen The rectal temperature remained low partially because the intracisternal pressure was not greatly elevated and also because of the cooling action of the oxygen in the nasopharynx of the dogs.

This evidence would seem to indicate that barbiturates produce an anoxemia through alterations in the depth of respiration. The work of Jowett and of Hundhausen shows that barbiturates also cause a depression of oxygen utilization by the brain tissue through a direct histiotoxic action. The anoxemia and histiotoxic action alone produce only slight and insignificant elevations in cerebrospinal fluid pressure and no alteration of cerebrospinal fluid protein and cell content. The superposition of mild trauma such as occurs with slow aseptic withdrawal and replacement of from 35 to 50 per cent of the total volume of cerebrospinal fluid results in shock and edema of the brain. The increased permeability of the capillaries results in increased exudation of protein and cells causing significant elevations in cerebrospinal fluid pressure. The elevation in temperature is appar-

ently due to the direct effect of the increased intracisternal pressure upon the temperature regulating center in the brain stem. Oxygen therapy restores the oxygen content of the blood even above normal, restores capillary tone so that less protein and fewer cells pass into the cerebrospinal fluid and the intracisternal pressure becomes elevated to only a moderate degree.

CONCLUSIONS

1. Pentobarbital and amytal anesthesia produce a decrease in the oxygen saturation of arterial blood which persists for more than 4 hours.

2. The barbiturates produce only slight elevations of cerebrospinal fluid pressure, or 23 to 29 millimeters above normal and no significant alterations in spinal fluid protein or cells.

3. Aseptic cisternal withdrawal and replacement of 8 cubic centimeters of cerebrospinal fluid causes an increase of 122 milligrams per cent in cerebrospinal protein, an average cell increase of 1,294, a marked elevation of cerebrospinal fluid pressure, 124 to 156 millimeters, an increase in body temperature of 3.9 to 4.2 degrees F. and in respiration of 9 to 19 above normal.

4. Nasal oxygen therapy restored arterial oxygen saturation. The amount of protein was reduced to 53 milligrams per cent and the number of cells in the cerebrospinal fluid was also reduced to 672. Elevations in cerebrospinal fluid pressure were moderate, only 69 to 63 millimeters, and returned to lower levels sooner than in dogs which did not receive oxygen. Elevations of temperature and respiration did not occur.

5. Oxygen therapy is indicated for the amelioration of symptoms and reactions incident to barbiturate poisoning and cerebrospinal intervention.

Sincerest appreciation is expressed to Dr. Frank W. Hartmar. and Dr. Roy D. McClure for their co-operation which has made this work possible.

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THE MANAGEMENT OF HEMATOGENOUS PELVIC OSTEOMYELITIS

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ADVANCES in diagnosis and clinical life history of hematogenous osteomyelitis of the pelvic girdle emphasize the need for remediable interpretation of operative results and revision of therapeutic indications. Early recognition of the disease results in a conservative attitude toward initial surgical treatment as a paradox to the urgency of immediate operation and necessity for later radical methods. A review of the literature and an analysis of 109[1] cases suggest that therapeutic confusion has arisen from failure to appraise the local lesion in its relationship to the associated systemic infection in the early stages of the disease. Consequently indiscriminate initial operations and subsequent temerity have reflected unfairly upon and discredited sound surgical procedures, in reference to the mortality and morbidity of the disease.

Unbiased observation of the local lesion, at any stage of its development, will determine the treatment on its own merits. Therapeutic methods appropriate for the subacute and chronic phases of the disease are ill advised during its initial manifestations. As a matter of fact the early clinical situation has been distorted by the prevalence of chronic lesions, the pitiful condition of which has prompted the conception of eradicative measures at the onset of symptoms. This ideal is moderated with the realization that such patients have survived the original bacterial systemic onslaught in spite of surgical delay. Now the initial phases of the problem emerge in their proper ratio to the forefront of clinical attraction.

Vague retrospective therapeutic impressions, based upon distal extremes of the disease, yield to clarification from its proximally superimposed systemic and local levels. The latter furnishes the key to the therapeutic problem as a whole because of the initial unpredictable pathogenetic factors which govern the subsequent course of the disease. The obstacles to an immediate interpretation of the local therapeutic requirements demand a progressive objective evaluation of the entire clinical situation from its inception. This paper is based on the premise that the tendency toward natural compensation as reflected in the pathogenesis and pathology of the disease, indicates a therapeutic pattern in harmony with its clinical life history. It is my purpose to refer to those factors which determine a distinctive clinical grouping of cases, and to discuss their diagnosis and therapeutic management.

[1]The vast majority are from the University Hospitals at Iowa City; the remainder from the St. Joseph and Missouri Methodist Hospitals, St. Joseph, Mo.

PATHOGENESIS

Since the entire life history of the disease has not yet been evolved its diagrammatic representation is arbitrarily divided into preclinical and clinical phases (Chart 1). The former includes assumed but convincing trigger causal and predisposing factors; namely, port of bacterial entry, trauma and lowered immunological resistance. Topical and general infections, and direct and indirect injuries often precede the onset of pelvic osteomyelitic symptoms. The primary infectious focus as an active, latent, or potential source of danger requires elucidation. Rarely a hematogenous osteomyelitis occurs at the site of a simple fracture of the pelvis. The reactivating influence of trauma in flares is recognized.

Although the clinical division is neatly separated into systemic and local elements, the dynamic reciprocal interrelations of the various stages is fundamental. The most important item in the early stages as a rule is the general infection. It comprises the stages of bacteriemia and bacterial bony "seeding." Contrary to casual opinion hematogenous medullary may be substituted by cortical,

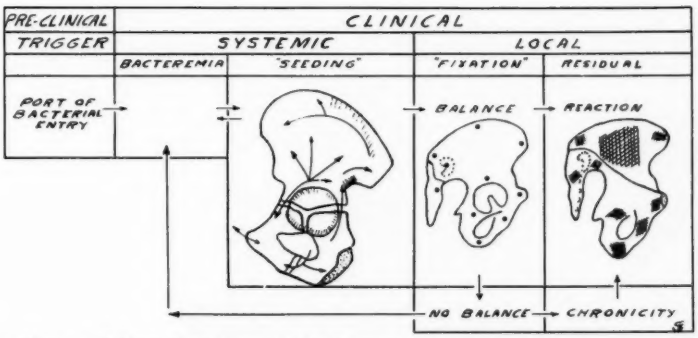

Chart. 1. Schema of pathogenetic development and course of hematogenous pelvic osteomyelitis.

articular, juxta-epiphyseal or subperiosteal "seeding," depending upon specific vascular sensitization.

The local level of the disease is characterized by bony "fixation," development of the local lesion, and its residual scar. "Fixation" is initiated by a thrombo-embolic process which may continue independently by retrograde progression (Fig. 1). Wilensky's studies hardly admit of any other explanation. Ollier's teachings of the importance of the juxta-epiphyseal zone in the development of hematogenous osteomyelitis of the long bones is basic. Goulliad (quoted by Badgley) carried this analogy to the pelvic situation. He conceived the diphasic focal syndrome corresponding to the two periods of its bony development. Skeletal localizations usually occur proximal to the acetabulum before puberty, and henceforth in the vicinity of the secondary marginal epiphyses (Fig. 2).

The least understood of all pelvic foci are derived from the sacro-iliac synchondrosis. Accurate differentiation between bony and articular lesions is imperative. This is not difficult in cases carefully observed from the onset of symptoms. The possibilities in this respect are apparently determined by the same factors which govern hematogenous pyogenic bone and joint infections in general. Lesions affecting this region are classified as: isolated suppurative arthritis of the sacro-iliac joint, juxta-articular osteomyelitis of the sacrum or ilium, and/or a pan-osteomyelo-arthritis (sacro-ileitis).

Suppurative evolution of the local lesion effects an equilibrium between the systemic and local infection in the usual case. The end-result is then determined by the local lesion. When such balance is delayed or does not occur, the disease may continue indefinitely, or the end-result is fatal due to uncontrollable complications. The mortality from an uncomplicated local lesion is nil. Not infrequently the lesion evolves without gross evidence of suppuration.

The residual stage of the lesion results from the reaction between the inflammatory process and the collateral ischemia incident to the underlying thrombo-embolic process. Local balance is usually expressed by sequestrum formation which in turn may disturb its stability.

PATHOLOGY

Para-osseous abscesses dominate the gross pathological situation. They often mask the bony lesion and are formidable sources of local infection and toxic absorption. They frequently spread out of fascial bounds by active lateral expansive dissection. The rapidity and direction of purulent progression either horizontally or vertically depends upon its origin relative to the bony surfaces.

Suppuration arising from the posterior segment of the bony pelvis usually collects in the iliopsoas or subiliacus space. Not infrequently they emerge below the greater sacrosciatic notch or above the brim of the pelvis in the retroperitoneal tissues. Pus originating from the sacro-iliac joint perforates the antero-inferior weakest portion of its capsule into the iliopsoas or subiliacus space. That from the

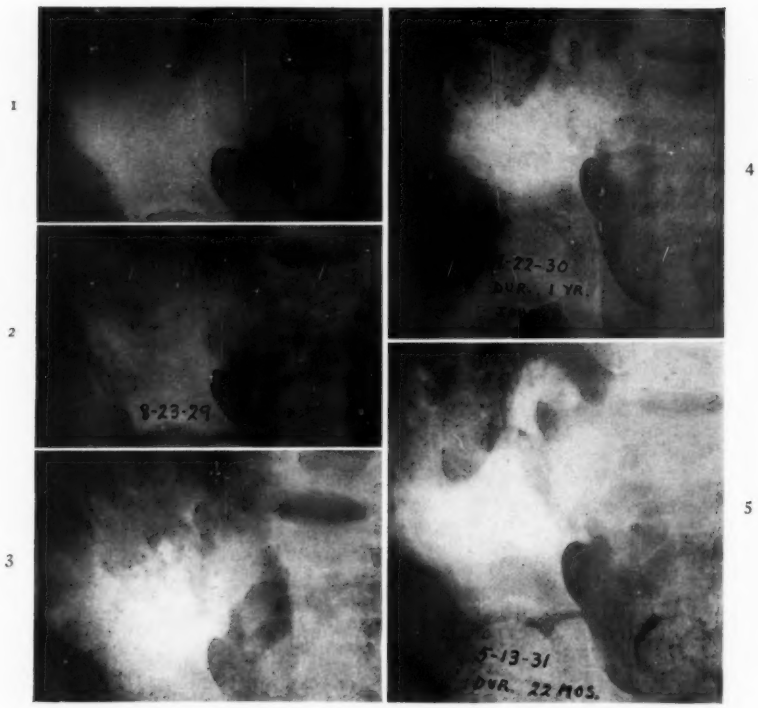

Fig. 1. Roentgenograms of an iliac lesion illustrating characteristic extension by retrograde progression and complete evolution of the lesion. Duration: 1, 11 days; 2, 21 days; 10 days after simple incision and drainage; 3, 5 months; 4, 1 year; 5, 22 months.

ischium fills the subgluteal space and occasionally the ischiorectal fossa. It may also burrow along the ascending ramus of the ischium to the groin, scrotum, or vulva. Pubic foci involve the space of Retzius or Scarpa's triangle, and the adductor region. Foci originating above the iliopectineal line form characteristic abscesses in the internal iliac fossa.

Due to the intimate relation between the pelvic and femoral fascial spaces (Prentiss, Milgram) the anterior and posterior fascial compartments of the thigh may be invaded. The most bizarre routes of gravitational and even retrograde purulent infiltration is frequently observed. Huge retroperitoneal collections of pus may result from any pelvic focus. Pelvic viscera are rarely perforated. The virulence of deeply situated abscesses occasionally becomes spontaneously exhausted, or remains as an asymptomatic ("silent") source of remote metastatic infections.

Para-osseous edema and juxta-epiphyseal hyperemia is the earliest surgical pathological change noted. In the second or third week an iliac lesion is distinguished as a pale moth-eaten island with marginal congestion and early patchy involucrum which is already partially imbedded in granulation tissue. Finally gross exfoliation and sequestration is not as uncommon as the literature would indicate (Fig. 3). Those from the iliac wing lead to variegated but characteristic cistern formations in the internal iliac fossa. Extensive ischial sequestra often lie in a soggy bed of infective granulation tissue from which they can be lifted out *en masse*. Sequestra in relation to the sacro-iliac synchondrosis are usually situated antero-inferiorly as sharply

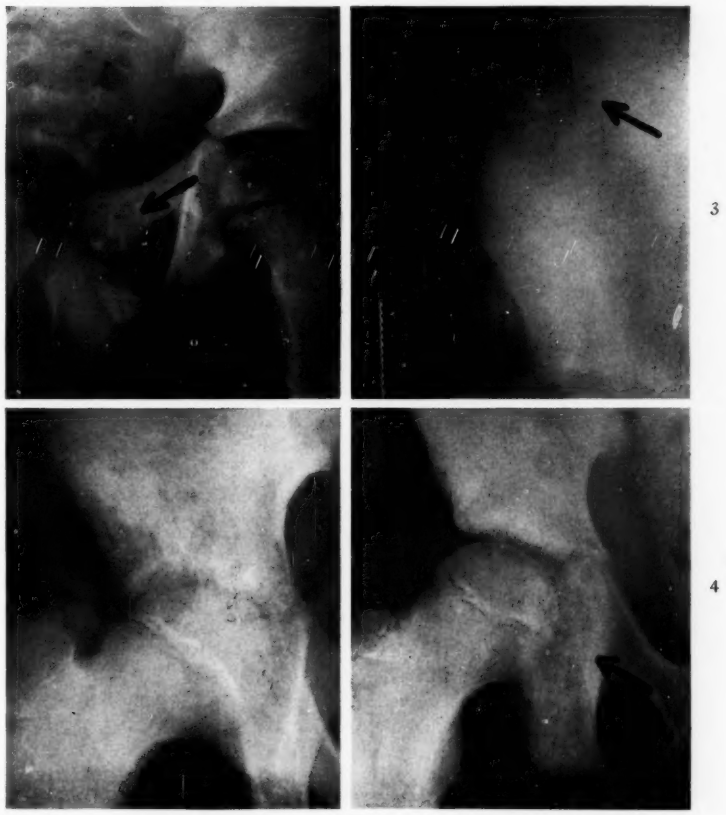

Fig. 2. Roentgenograms illustrating characteristic developmental localization of the disease: 1, Ischiopubic, male aged 7 years, 2 weeks' duration; 2, supracotyloid, female aged 11 years, 33 days' duration; 3, anterosuperior border of the ilium, female aged 13 years, 8 weeks' duration; 4, subcotyloid, ischium, female aged 6 years, 36 days' duration.

outlined triangular portions or slivers of the ilium or sacrum.

The characteristic histological sequence is disclosed as an acute cellular, subacute dry fibrous reaction and final simultaneous resorption of dead and reorganization of new bone. It is evident that passive reaction at a distance is clinically often interpreted as an active destructive participation. The epiphyseal cartilage does not show abnormal changes in the initial stages. The most intensive interstitial marrow invasion of acute inflammatory products and scattered necrosis of bone cells occurs at the initial site of origin. There is an almost immediate response by granulations which are intricately pervaded and supported by a network of very immature osseous tissue. Henceforth lacunar resorption and bony reapposition go hand in hand.

Chronic lesions reveal almost a complete absence of normal hematopoietic marrow and are predominated by irregular osteosclerotic inflammatory reaction and reorganization. The marrow is displaced by hyperemic fibrous tissue which may still show evidences of slight cellular infiltration. Marked osteoclastic resorption continues about sequestral craters, and here the deeper layers of the granulation

TABLE I.—AUTHOR'S SCHEMA OF THERAPEUTIC INDICATIONS ON BASIS OF CLINICAL DEVELOPMENT

Divisions	Preclinical	Clinical			
Phases	Trigger	Systemic Level		Local Level	
Stages	Primary infection	Bacteriemia	"Seeding"	"Fixation"	Residual
Clinical development	Variable	Toxemia	Abortive—presuppurative	Non-suppurative Suppurative	Sequestrum
Symptoms	Variable	Acute infectious disease	Subjective—"osteomyelitis conscious"	Objective Clinical diagnosis	X-ray
Treatment	Primary control			Secondary control	
	Prevention and prophylaxis	Hospitalization	Sedation Mechanical	Conservative operation	Radical operation
	Symptomatic Immunotherapy	Symptomatic: fluids, transfusions, immunotherapy, chemotherapy		Prevention of secondary infection and deformity (Orr method)	

tissue form scar. On the surface there may still remain an exhausted (necrotic) exudate in which are numerous necrotic bone spicules in an advanced stage of organization and resorption. Lesions of the sacro-iliac synchondrosis show variable changes, such as loss of the joint cartilage, calcification or obliteration of the joint, and reactive sclerosis of the opposing bones.

Extension by bony contiguity belongs to the later neglected stages. The peculiar bony configuration of the innominate bone facilitates mechanical extension along architectural trabecular systems. This not infrequently leads to hemipelvic and even lumbosacral involvement. Hip joint complications are common and may be predicted from supracotyloid and infracotyloid juxta-articular foci. Contiguous spread of lesions affecting the sacro-iliac synchondrosis often obscures its exact focal point of origin. Medial sacral invasion may determine a fatal outcome from meningeal involvement (Fig. 4). On the other hand the denser contiguous portion of the ilium is often an effective barrier to lateral extension of the lesion.

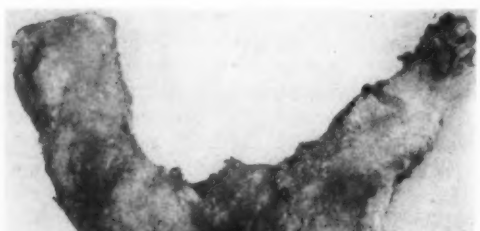

Fig. 3. Photograph of operatively resected ischial lesion of 6 years' duration. Microscopically the entire ischium was necrotic. The immediate para-osseous tissues formed a cloaca for ramifying sinuses emanating from intrapelvic and extrapelvic depths.

The residual stage of the disease is conspicuous by uncontrolled new bone formation which has its redeeming as well as unpleasant features. The tendency toward regeneration —even after total resection—is almost certain in the young. The amount and irregularity of new bone formation may add to technical operative difficulties and obscures roentgenographic interpretation of the primary lesion. This power of the periosteum, however, may be weakened or inhibited entirely in older persons or because of constitutional inferiority, initial thrombosis, death of the periosteum from intense parosteal infection, therapeutic neglect, and indiscriminate operative interference.

BACTERIOLOGY

The staphylococcus is recovered from the blood stream and local lesion in the great majority of instances under proper conditions. Sterile cultures always indicate a careful differential laboratory and clinical study. The mixed bacterial forms, most commonly a combination of staphylococcus and streptococcus, are usually due to secondary infection. The bacteriological significance of pyogenic hematogenous osteomyelitis is becoming more clearly defined. Many organisms exert a limited influence and are characterized by a more or less benign inflammatory reaction and clin-

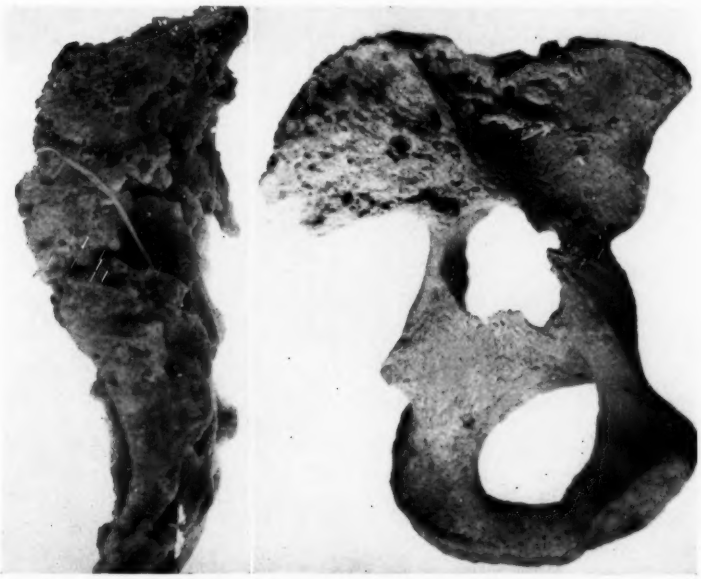

Fig. 4. Photograph of postmortem pelvic specimen of an extensive residual sacro-ileitis in a male aged 17 years, 18 months after onset. Left to right, lateral articular view of diffusely involved sacrum; no doubt the original site of the disease. Sacral canal and meninges were terminally affected. Internal surface of ilium showing ineffective but marked reactive juxta-articular sclerosing response to invasion of the iliac wing and acetabulum.

ical course. Streptococcal and some of the more unusual forms of bacteria often belong to the latter group. The necrotizing action of staphylococcal exotoxin is claiming renewed interest in regard to immunotherapeutic possibilities.

DIAGNOSIS AND CLINICAL COURSE

The symptomatic expression of the disease permits clinical grouping of cases on the basis of the pathogenetic development (Table I). But it is important to remember that the systemic manifestations may merge, appear simultaneously with, or be preceded by, the local subjective and objective symptoms. The systemic subgroups, abortive and presuppurative, are introduced to designate subjective symptomatic peripheral invasion of the skeletal tissue. Both classifications are symptomatically identical but should not be employed synonymously. If the course of the disease terminates spontaneously with no residual subjective or objective local signs and symptoms, it is called abortive. When the term "presuppurative" is used one looks tentatively forward from the initial stages of the disease, since suppuration may yet occur.

The local fixative subgroups, non-suppurative and suppurative, indicate conclusive objective peripheral skeletal invasion and participation. These, too, are symptomatically almost identical initially, but develop differently. By non-suppurative usage one looks backward on the acute stage from the stage of convalescence. The term should be reserved until all danger of local suppuration has passed, although residual bone changes may have progressed even to the stage of sequestration. Spontaneous regression even under such conditions is yet possible. The residual stages of the local lesion or scar are ushered in by gross bone changes, demonstrable on x-ray examination and usually characterized by demarcation of affected bone.

Fig. 5. Roentgenogram of sacro-iliac suppurative arthritis, 1 year after onset and 2 weeks after an uneventful obstetrical delivery of a normal infant. "Unhooking" at the symphysis is associated with sacro-iliac joint ankylosis.

Fig. 6. Roentgenogram showing residual sacro-ileitis with typical lateral pelvic shift.

Since the local lesion is of hematogenous origin the systemic infection demands primary consideration, and one should be ever on the alert for localizing signs and symptoms of suppuration. The initial clinical problem simply stated is therefore presumptive diagnosis and surgical therapeutic restraint. The uncertainty of an immediate conclusive diagnosis, the severity of the general infection, and the unpredictable course of the disease precludes any other line of action.

A reasonably early diagnosis depends upon an awareness of the relative frequency of the disease as it affects all portions of the pelvic girdle. The various lesions in this series were distributed as follows: ilium, 39; ischium, 26; sacro-iliac synchondrosis, 22; sacro-iliac joint, 10; pubis, 8; sacrum, 3; and coccyx, 1. Since there are no basic differences between these foci in reference to differential diagnosis, mortality, morbidity, and therapeutic indications, the clinical situation is best considered as a whole.

In the acute stages of the disease the initial lesion is characteristically subordinated to, or masked by, the systemic reaction and simulative signs and symptoms referable to visceral, retroperitoneal, and hip joint irritation. The profound toxemia, positive blood culture, absence of position of relief and responses to spontaneous and provoked pain, should suggest the true nature of the condition. Initial peripheral objective signs and symptoms, such as edema, superficial venous engorgement, and generalized tenderness, indicate a definite shift to the local or diagnostic level of the disease. Major responsibility now centers about evaluation of the concomitant triad of symptoms referable to the hip joint, such as pain, tenderness, and asymmetrical attitude.

The hip joint may be either primarily, simultaneously, or secondarily affected from a rapidly extending juxta-articular lesion. Marked symptoms referable to the hip joint associated with obturator nerve radiation are almost pathognomonic of its relative or absolute participation, although painful obturator or sciatic nerve reference is not infrequently observed in uncomplicated instances of pelvic osteomyelitis. When digital tenderness accompanies painful radiation the possibility of an associated femoral lesion should be considered.

Primary hip disease is physically expressed by an absolute or concentric restriction of function. The resultant spontaneous deformation of the hip joint is characterized by flexion, abduction, and external rotation. However, some degree of motion may be elicited early before the joint cartilage is involved and later because of ligamentous and capsular relaxation incident to hydrostatic distention.

As a corollary to this the sympathetic asymmetrical attitude of the hip due to juxta-

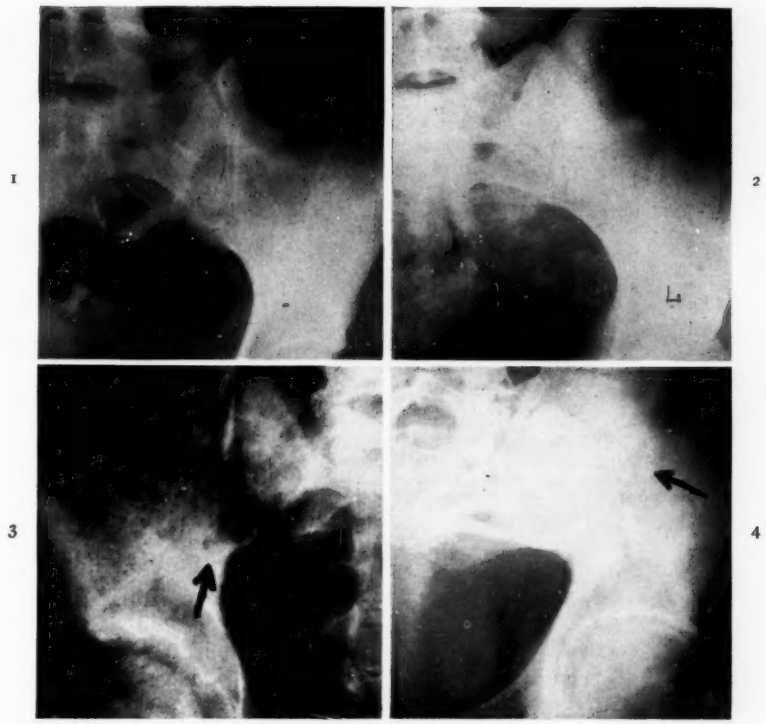

Fig. 7. Roentgenograms of lesions affecting the sacro-iliac synchondrosis illustrating early and later differential characteristics between bone and joint participation. 1, Sacro-ileitis of 3 weeks' duration, characterized by osteoporosis and accentuation of the iliac juxta-articular vascular channels; 2, sacro-iliac joint suppuration of similar duration characterized by blurring of the articular margins, beginning reactive para-articular increased calcification and loss of the vascular striæ. No disturbances of pelvic equilibrium were noted in either case at this stage; 3, sacro-ileitis of 6 weeks' duration showing destruction, sequestration and pelvic shift in contrast to, 4, old residual sacro-iliac suppurative arthritis of 11 years' duration showing resultant para-articular sclerosis fusion of the joint, and absence of pelvic asymmetry.

articular or para-articular foci, is activated by relative protective muscle spasm. Extra-articular conditions will allow a considerable range of motion in planes unaffected by pelvi-femoral or lumbopelvic muscles arising from or inserting at sites of involvement. Later this attitude becomes more pronounced as a result of purulent hydrostatic infiltration. Still later deformity becomes more or less fixed due to bony pelvic distortion or destruction, or actual invasion of the hip joint.

When the focus is in the ilium, the hip is characteristically in flexion and abduction. Flexion predominates when the lesion arises from the sacro-iliac region. Ischial foci result in external rotation of the femur and abduction. Pubic lesions lead to flexion, adduction, and internal rotation.

The general reaction, pain, tenderness, eccentric limitations of hip joint motion, and *negative hip aspiration* are strongly suggestive of an acute osteomyelitis of the pelvis. Actual infiltration, fluctuation, and circumscribed tenderness, all of which are confirmed by vaginal or rectal examination, and focal aspiration, clinch the diagnosis.

Now if clinical equilibrium is established the patient is less apprehensive and more com-

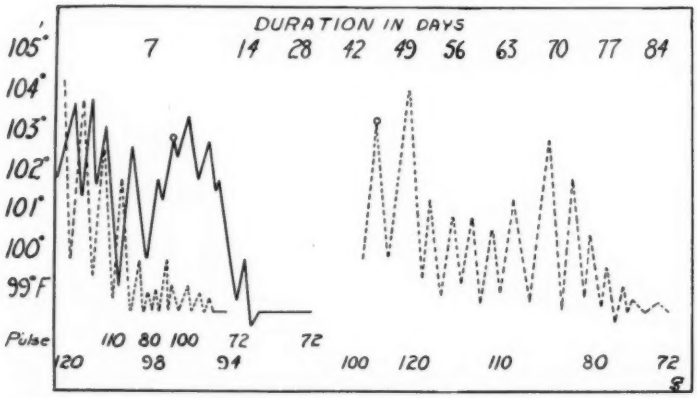

Chart 2. Superimposed diagrammatic temperature records of 2 parallel ischiopubic lesions which were treated by simple incision and drainage of the para-osseous abscess. The solid and broken lines demonstrate the course of the disease after operation on the ninth and forty-sixth days, respectively; delay in the latter was due to spurious regression of symptoms and premature discharge of the patient. The bony lesions in both instances regressed spontaneously.

fortable. The formerly sustained fever may now break and even touch the base line. The sedimentation rate decreases and the pulse rate is lower. *The definite ascertainment of local suppuration is of primary importance and the surgeon's gravest responsibility.* If surgery is to influence the further course of the disease at all it must depend upon reasonably early recognition of para-osseous suppuration. (Chart 2). The most important single diagnostic method for its detection is aspiration, under anesthesia if necessary at the point of maximum tenderness.

ROENTGENOGRAMS

Adequate roentgenograms are indispensable for differential diagnosis and careful operative planning. The earliest sign (about the second week) appears as a localized osteoporosis and is soon followed by periosteal reaction, destruction, sequestration and bone production. Blurring of the skeletal, epiphyseal and joint structures is soon observed under proper conditions. Any delay of osteoporosis is due to the calcific attempt at restriction of the pathological process and would indicate watchfulness and surgical restraint.

Careful technique and interpretation will indicate early relevant intrinsic and extrinsic pelvic changes. The obturator foramen may be clouded by an abscess originating from the ischium. The fascial, capsular, and muscular distortions and disturbances of pelvic equilibrium are very significant. The former are due to active purulent or serous infiltration and distention. The latter are passively initiated by muscular imbalance, but are later accentuated or fixed by active progressive destruction and loss of bony tissue and joint relaxations.

Static and mechanical distortions of the pelvic girdle are often delayed and sometimes prevented by the voluntary or enforced recumbency assumed by the patient, and sometimes by persistent preventive measures. "Unhooking" (Fig. 5) at the symphysis pubis results from sacro-iliac joint lesions proper, and is not always associated with subluxation of the latter. On the other hand destructive lesions of the synchondrosis (sacro-ileitis) are characterized by a total lateral shift of the bony pelvis toward the unaffected side without pubic displacement (Fig. 6). This is also associated with an upward displacement on the affected side especially after partial or total operative resection of the sacro-iliac synchondrosis.

The sacro-iliac region is notoriously difficult

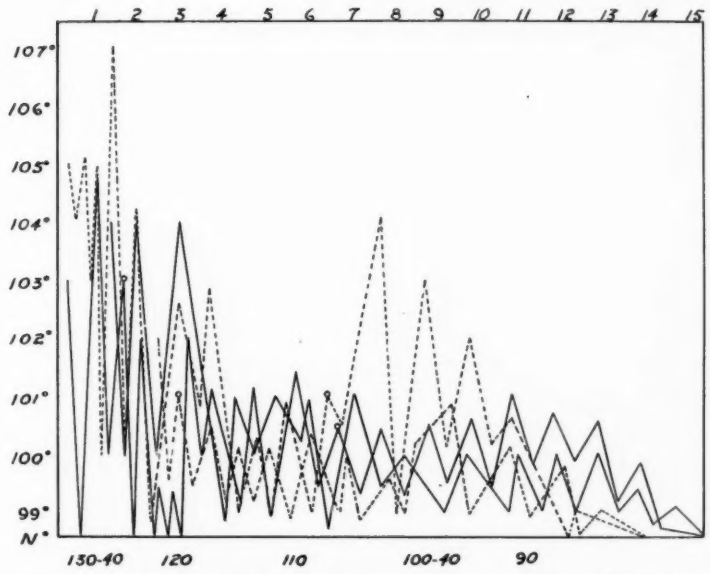

Chart 3. Superimposed diagrammatic temperature records of 4 parallel lesions. Broken lines indicate ischial and the solid lines iliac foci. Resections were performed in the second, third and sixth weeks of the disease.

to interpret roentgenographically. There are numerous variations within normal limits. The tendency toward spontaneous obliteration of the joint in older individuals is often observed. It is helpful to remember that the anterior and posterior margins of the sacroiliac joint, except in the very young, are distinctly separated on an anteroposterior plate, the anterior appearing laterally. In the very young both margins are practically superimposed. In any event careful comparative analysis with the unaffected side is essential for the recognition of initial manifestations (Fig. 7).

Early perforation and egress of pus from any focus minimizes bony changes. Lesions beginning and continuing centrally either by contiguity or retrograde thrombosis, yield the most striking roentgenographic changes, the latter often resembling a "rotten ice" (Dr. A. B. McGlothlan) appearance. A roentgenographic distinction between extension by retrograde thrombosis and contiguity is possible in lesions studied at intervals from the onset of symptoms.

The former occurs rapidly and results in a marked mosaic-like breaking up of an entire segment of the bony pelvis on the basis of a pronounced general osteoporosis, which results finally in typical sequestrum formation. This is demonstrated best in instances affecting the wing of the ilium. The latter occurs more gradually; the advancing margins are preceded and accompanied by a reactive sclerosis and terminate finally in less typical exfoliation of bone. Extension by vascular mechanism is almost invariably associated with continued marked systemic manifestations while that resulting from contiguity is locally expressed. Sinus injection with a radio-opaque solution in the later stages is an important aid to diagnostic localization.

TREATMENT

The treatment is based upon the primary and secondary control of the disease and patient as a whole (Table I). Primary control is essentially the medical or symptomatic management of the preclinical and systemic phases of the disease. Secondary control or

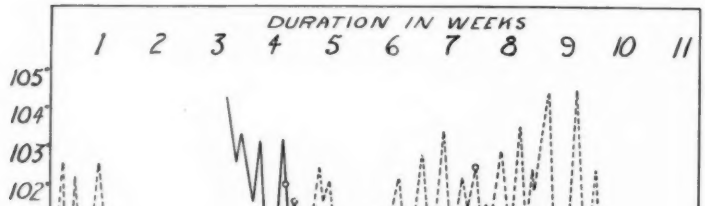

Chart 4. Superimposed diagrammatic temperature records of 2 lesions involving the sacro-iliac synchondrosis. The broken line represents an instance of isolated suppurative arthritis treated by simple incisions of intrapelvic and extrapelvic abscesses, and the solid line a sacro-ileitis, which was subjected to an initial conservative and a delayed radical operation.

operative treatment of the local lesion is dependent upon suppurative and residual phenomena.

Prevention and prophylaxis demand adequate treatment and guarded convalescence from focal and general infections; social hygiene and supervision of activities for those who might be expected to develop the disease. Since it has been found (Robertson) that topical skin infections do not excite an antitoxin increase in the circulating blood, administration of staphylococcus toxoid and/or antitoxin is suggested.

Careful observation and deliberation is the keynote of therapeutic management of the clinical level of the disease. The general condition of the patient and the presence or absence of pus must guide the conscientious surgeon on the basis of his experience. *Operation is contra-indicated until definite suppuration has occurred*, and evidences of clinical equilibrium are manifest.

The most aggressive measures are usually first directed against the systemic infection, by sedation, chemotherapy and immunotherapy (sulfanilamide or its derivatives, and staphylococcus antitoxin), oral and parenteral fluids, repeated small transfusions, sedation and traction, the latter forming the first line of defense against impending deformity.

Theoretically it would appear that immunological therapeutic efforts should be most effective at the very inception of the disease. It may be axiomatically stated that traction and pelvic sling suspension will relieve subjective pain due to initially spontaneous muscle spasm, whether they arise from pelvic girdle or hip joint lesions. Further progression of the lesion in either situation results in recurrence and intensification of symptoms due to increased intra-articular pressure in the latter and actual purulent infiltration of muscular compartments in the former.

Curiously enough early radical resection (Chart 3) did not diminish the period of convalescence as compared with those patients in whom it was delayed. Therefore, secondary control of the disease is inaugurated by a well timed and planned incision and drainage of the para-osseous abscess. The subsequent course of the lesion determines further operative indications. This is best exemplified in foci affecting the sacro-iliac synchondrosis (Chart 4).

Simple incision and drainage is usually followed by relief and continued improvement in sacro-iliac joint disease. The clinical syndrome soon recurs if the lesion originates from an osteomyelitic focus or if active extension takes place. Interval roentgenographic stud-

ies soon reveal unmistakable evidences of paraarticular bony participation and its demarcation in due time. Now the urgency of radical intervention should be boldly accepted and satisfied. The feasibility of the latter procedures is not yet fully appreciated, but are seldom advisable before the second month of the disease (Chart 4).

Since secondary control of the disease is based on anticipation of local complications, Orr's general principles of treatment are instituted and persisted in from the onset of peripheral subjective symptoms. The radical measures so essential in the residual phases of the disease would not be otherwise feasible. Locomotor disturbances of mechanical origin and secondary infection can be most uniformly controlled by adequate rest of the parts and minimal interference with the postoperative sinus. The use of gauze impregnated with cod liver oil ointment (White) is suggested as an adjunct to the ordinary vaseline pack. Operative wounds must be left wide open. The tendency toward premature closure is remarkable in these deep-seated lesions. The Roger Anderson splint as a preliminary and postoperative preventive measure against deformity is also suggested.

A flare-up demands the same serious consideration as that given to the initial evolutionary phases of the disease. Its evaluation and management will often tax the patience, judgment, and ingenuity of the surgeon to the utmost. When the flare-up is associated with a marked systemic reaction the primary threat to the patient's life is reduplicated. The patient's volunteered subjective sensations should be carefully noted as an aid to diagnostic evaluation of the situation.

OPERATIVE HINTS

All initial incisions are made generously to facilitate maximum drainage of the bony focus. Iliopsoas and subiliacus abscesses are evacuated along the anterior superior border of the ilium. The subgluteal space is drained laterally. Occasionally pus from the sacroiliac region is reached below the sacrosciatic notch or through Petit's triangle. The fascial compartment of the thigh requires long lateral or posterior incisions. Successful achievement in radical operative methods depends upon careful preparation of the patient, control of hemorrhage, and convalescent supervision. Adequate procedures are essentially partial or total subperiosteal resections.

For the sacro-iliac synchondrosis, the author employs the Bardenheuer-Picque technique. The incision follows through the fibrous origin of the gluteus maximus. Stripping is continued down to the vulnerable superior gluteal vessels which emerge under the greater sciatic notch. The posterior iliac flap is defined with the motor saw, or mallet and chisel. In partial or subtotal resection the heavy ridge of bone just above the sciatic notch is spared. The removal of affected sacral portions then continues as indicated.

Following Badgley's technique for lesions of the ilium, the entire external soft tissue flap is stripped down to the margin of the acetabulum through a Smith-Peterson approach. Posteriorly, this continues to the greater sciatic notch, and is completed by exposure of the internal surface of the ilium down to the arcuate line. Affected bone is then removed piecemeal or *en masse* as necessary.

The author utilizes a posterior incision through the gluteal fold for lesions of the ischium. The lowermost fibers of the gluteus maximus muscle are retracted upward and laterally or may be partially incised. The sciatic nerve is next isolated and protected. The periosteum and ligamentous attachments of the tuberosity are incised vertically to the bone in the midline. Subperiosteal exposure proceeds to the inferior border of the acetabulum or pubis as indicated. Subperiosteal exposure proceeds to the floor of the acetabulum or pubis as desired.

CONCLUSION

More recent studies by Crossan, and others, of the mortality and morbidity of acute pyogenic hematogenous osteomyelitis of the long bones, challenge the validity of immediate operative intervention. Wilensky's classification of the disease, based upon end-results of operation, however, is the first distinctive modern plan of treatment. His clinical grouping of cases, in reference to therapeutic indications, is classic and is the result of intensive

observation and investigation. Orr's principles of treatment, properly timed, solve the practical problems involved in the actual management of the disease and patient as a whole, from the general surgical and orthopedic aspects.

Present day concepts of the therapeutic management of hematogenous osteomyelitis have evolved chiefly from an increasing knowledge and harmonious interpretation of the variable clinical life history of the disease, which finds adequate expression in the pelvic situation. The disease as it affects the pelvic girdle presents an apparently unique problem. The immediate diagnostic and therapeutic obstacles encountered have unexpectedly but definitely dovetailed divergent conservative and radical methods of operative treatment.

The practice of operation, here, on mere suspicion of the lesion is impractical and dangerous, and should be condemned. Demonstrable suppuration remains the sole indication for initial operation in the early stages of the disease. The local and systemic benefit derived from a well timed simple incision and drainage operation is indisputable, but is not always followed by a dramatic recession of symptoms. The disease may continue as a severe local or general infection until the defensive mechanisms of the body begin to establish controlling influences. Radical intervention belongs to the residual phases of the disease, and is determined by the qualitative and quantitative state of the local lesion on its own merits.

Therapeutic control is dependent upon a reasonably early recognition of the disease, but even more so, the stage of development of the local lesion and its relation to the associated systemic factors involved. The disease is not a static process. Respectful observation of the lesion following "seeding" and the subsequent bacterial "lag" or period of adaptation is essential in the formulation and application of rational therapeutic measures.

A perspective of hematogenous pelvic osteomyelitis is herein presented from the viewpoint of its pathogenetic development. On this basis a clinical grouping of cases and their therapeutic management is possible which is in complete harmony with objective manifestations of the disease and sound clinical judgment.

The following are illustrative case reports clinically grouped according to their stage of development on admission to the hospital and therapeutic management.

I. ABORTIVE AND PRESUPPURATIVE

CASE 1. Velma B., aged 12 years, suffered with abortive osteomyelitis of the ilium. Acute systemic onset began 5 days before admission to the hospital, with severe pain in the right elbow and left hip region 2 days later. The temperature was 104 degrees F., and the white blood cells numbered 35,000. The lower humeral focus developed pus which was incised and drained on the fifth hospital day. The tenderness and infiltration over the posterior left ilium and eccentric hip spasm gradually subsided under traction. Patient made complete recovery. No recurrences were found 3 years later.

CASE 2. Glenn S., aged 13 years, suffered from presuppurative osteomyelitis of the ischium. Ten days previously he experienced insidious pain and disability in the left hip. The white blood cells numbered 20,900 and the temperature was 100 degrees F. Examination showed edema and tenderness about the gluteal region and ischium. Incision revealed only serous fluid. The fever rose to 103 degrees F., and remained irregular for several days. He was discharged practically healed 12 days later.

II. NON-SUPPURATIVE

CASE 3. Edward H. (courtesy of Dr. H. K. Wallace), aged 6 years, had a non-suppurative lesion of the ischium. Sudden onset occurred 2 weeks previously with chills, fever, and pain in the left hip. In one week all symptoms, except slight perineal discomfort and moderate fever, had subsided. Physical examination revealed digital tenderness along the ascending ramus of the ischium and eccentric hip spasm. X-ray film showed definite osteoporosis destruction and periosteal reaction affecting the tuber ischii. Spontaneous clinical recovery and bony reorganization occurred in about 3 months, following a period of recumbency, without operative intervention.

III. SUPPURATIVE

A. Cases in which there was no balance between the systemic and local infection. Fatality was due to uncontrollable complications.

CASE 4. Vernon M., aged 15 years, had a suppurative lesion of the ischium. The hip joint was surgically exposed on the day of admission because of a mistaken diagnosis. Operative treatment was delayed. Sudden systemic onset occurred 4 days previously, with pain in the right hip region. The white blood count was 24,000 and the temperature 104 degrees F. There was localized tenderness in the adductor region of the affected side associated with

eccentric muscle spasm. The blood culture was positive for the Staphylococcus aureus. A tibial metastasis developed 12 days after patient was admitted to the hospital. Forty-six days after onset a huge abscess was incised and drained from the posterior compartment of the thigh. The patient died 3 days later. Autopsy revealed massive necrosis of the ischium, destruction of the hip joint, an intrapelvic abscess, and multiple visceral metastases.

CASE 5. Leland E., aged 15 years, had an involvement of the ischium. Early operation did not prevent fatality. Four days previously he suddenly developed coxalgia, chills, fever, and delirium. Ischial tenderness and eccentric muscle spasm of the hip were noted. The white blood count was 18,600. The blood culture was positive for the staphylococcus. Two days later incision and drainage of the abscess was performed. After a brief period of general improvement, he became worse, coughed up bloody sputum, and died in the fourth week of his illness. No autopsy was performed.

B. Cases in which systemic and local balance had occurred.

1. Conservative operative treatment was inadequate.

CASE 6. John B., aged 7 years, had an infection of the ilium. The patient suddenly became ill 10 days previously with moderate fever and severe hip pain. The temperature was 102 degrees F., and the white blood cells numbered 34,400. Examination indicated marked tenderness about the iliac wing and evidences of fluctuation over the anterior superior spine. X-ray films showed osteoporosis and periosteal reaction at the anterosuperior border of the ilium. Incision with drainage of the abscess was done. The staphylococcus was recovered from the pus. The wound continued to drain profusely and patient exhibited a moderately severe septic course for about 6 weeks. Subsequent interval clinical and x-ray check-up over a period of several years showed extension and activity of the local lesion. No further operative treatment was, however, performed.

2. Conservative operative treatment was adequate.

CASE 7. Raymond J., aged 13, had an ischiopubic and femoral lesion. Acute septic onset occurred 6 days previously with bilateral pain in the thighs, rectum, and scrotum, and painful reference to the medial border of the left knee. The temperature was 103 degrees F., and the white blood count was 10,800. Relevant findings were general pelvic tenderness, eccentric hip spasm, and tenderness over the left lower medial femoral epicondylar region. Rectal tenderness was maximal at the ischiopubic junction. Three days later, simple incision and drainage of both pelvic and femoral foci resulted in an uneventful convalescence, recovery, and spontaneous bony reorganization of both lesions.

CASE 8. Edith S., aged 25 years (Fig. 5, Chart 4, broken line), had an isolated suppurative sacro-iliac arthritis. During the course of an induced septic abortion she suddenly complained of pain in the left hip region. Physical examination elicited eccentric muscle spasm and digital tenderness over the left mid ilium. The temperature subsided in 20 days, and was followed by a 10-day period of comparative comfort in traction. Two weeks later cloudy fluid was aspirated from the hip joint. Since no organisms were culturally recovered, traction was continued. Roentgenograms were inconclusive until slight "unhooking" occurred about 3 weeks after onset of local symptoms.

One month later an iliopsoas abscess became evident and was incised and drained. Cultures now grew long chained non-hemolytic streptococci from the abscess and hip joint. Subsequent drainage was profuse. In another 3 weeks the fever again rose to 105 degrees F., which subsided after a huge secondary subgluteal abscess was also incised and drained. Convalescence henceforth was smooth, and sound spontaneous healing of both joints occurred in about 3 months. The sacro-iliac joint fused spontaneously. The hip joint showed no residual untoward effects. There was no recurrence after an obstetric delivery about 1 year later.

IV. RESIDUAL

Adequate 2-stage radical operative treatment.

CASE 9. Helen S., aged 20 years, had a sacro-ileitis. Sudden onset occurred 4 weeks previously, with initial symptoms of an acute infectious disease and low back pain which radiated to the medial side of the right knee. The gross relevant physical findings were: loss of weight and right hip deformity. There was marked tenderness over the right sacro-iliac region posteriorly with infiltration of the soft parts. A large, tense, tender mass was palpable in the right iliac fossa extending to Poupart's ligament. The sedimentation rate was rapid. The white blood count was 10,650, and the temperature was 100.5 degrees F. The x-ray film showed typical destruction and sequestration of the sacro-iliac synchondrosis. Initial simple incision and drainage of the iliopsoas abscess was followed in a week by a subtotal resection. The subsequent convalescence was uneventful, and recovery occurred in 4 months, with partial bony regeneration of the affected region.

CASE 10. Florence K. (Chart 4, solid line), aged 21 years, had a sacro-ileitis. Three weeks previously she suddenly experienced chills, fever, sweats, nausea, and vomiting and severe persistent pain in the left hip region. The temperature was 102.5 degrees F., and the white blood count was 32,650 The left hip was semiflexed, and exhibited eccentric muscle spasm. Maximum tenderness over the left sacro-iliac region was confirmed by digital rectal examination. The blood culture grew gram positive cocci in groups and in chains after 4 days of incuba-

tion on 2 occasions. The sedimentation rate was moderately increased.

Under symptomatic and mechanical supervision the general and local condition was improved. On the sixth hospital day (1 month after onset of symptoms) a demonstrable subiliacus mass was incised and drained and was attended by local and general improvement. Three days after operation painful symptoms recurred. Interval roentgenographic investigation indicated unmistakable evidences of sacro-ileitis. Eleven days after her first operation (about 6 weeks after onset of illness), she was subjected to a total sacro-iliac resection. The convalescence was uneventful and healing occurred in about 5 months.

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CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, NORTHWESTERN UNIVERSITY

THE MIKULICZ OPERATION—DEVELOPMENT AND TECHNIQUE

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IN reviewing the origin and development of what is known as the "Mikulicz operation," several distinct contributions are recognized as having pointed the way to its definitive technique. The Mikulicz operation consists of 3 distinct parts: first, the exteriorization of the loop of the diseased bowel; second, the formation of a double barreled colostomy; and third, the elimination of the spur with the re-establishment of continuity of the bowel. Each of the steps in this operation was accomplished long before the era of antiseptic surgery.

Early literature(4) records examples of "colostomy necessitatis" in which herniation of a segment of intestine was followed by sloughing of the external loop with spontaneous formation of an external colostomy. In this manner, intestinal obstruction was overcome by a natural process. Thus, the first two parts of the Mikulicz operation entail the application of a principle that had been pointed out by Nature's method. The third part of the operation, destruction of the spur with the restoration of continuity of the bowel, is of more recent origin and dates back to a little more than a century ago.

In J. Syng Dorsey's *Elements of Surgery*, published in 1813, volume 2, page 67, there appears the following:

"In a patient with artificial anus at the Pennsylvania Hospital, Dr. Physic performed an operation which will probably be found to afford complete relief in many similar cases. The sides of the intestine, in this instance, were consolidated laterally, or in Mr. Cooper's language, like a double barreled gun. In order to ensure this union, a ligature was passed through the intestine and suffered to remain a week, keeping its sides in close contact, after which Dr. Physic cut a hole in the side of the intestine where the two portions had thus united, and by stopping the external orifice, the fæces regained their natural route; the external aperture was afterwards healed, and the patient relieved from this most loathsome complaint; he has for several years enjoyed perfect health."

In 1828, Dupuytren recorded observations made in 1813 on a patient who developed an artificial anus with two stomas following sloughing of a strangulated hernia. He later observed several such cases and devised an instrument in the nature of a crushing forceps which he called an enterotome. This was used to crush the spur without danger of opening into the peritoneal cavity. This clamp has been in use for many years and many modifications have been made.

One can see from the foregoing that all of the principles involved in the Mikulicz operation were well established half a century before the era of antiseptic surgery, and another 25 years passed before this ensemble of principles was made use of in the further development of surgery of the large intestine.

In 1879, several variations in the technique of large bowel resection were recorded (13). Billroth did a bowel resection with closure of the distal end; the proximal end was brought out as a colostomy. During the course of a difficult resection, Schede brought out both ends of the bowel from the wound when he found it impossible to approximate them by suture. This was an improvised manner of terminating a resection of the colon. Gussenbauer of Liége and Martin of Hamburg each successfully removed a sigmoidal tumor with its mesentery and glands leaving a double barreled colostomy.

In 1880, Czerny resected a tumor and successfully exteriorized the afferent and efferent loops of bowel. In 1881, Bryant in attempting a lumbar colostomy for a stricture of the descending colon due to a scirrhous carcinoma, exteriorized the affected loop of bowel, resected the tumor, and implanted the stoma in the lumbar wound (15).

In 1884, Heineke described and illustrated in his *Compend of Surgical Operations* a multiple stage operation for resection of the colon. In the

first stage, the tumor was brought out and the mesentery to that portion of the bowel harboring the tumor was severed. The proximal and distal loops were placed side to side. The tumor was then removed and the bowel was sutured into the abdominal wall. Later, closure of the openings was done by freeing the 2 stomas after crushing the spur with intestinal forceps. *This was the first time that deliberate division of resection of colon carcinoma into three stages was suggested.* There is no reference, however, that this graded operation was actually performed on a patient.

The time interval that elapses between the exteriorization of the diseased loop of bowel and the establishment of the double barreled colostomy is of importance in permitting the development of protective adhesions about the operative site. When in 1885 Maydl advocated the two stage left iliac colostomy with opening of the bowel on the fourth day, he emphasized this important feature of the modern operation.

In England, Davies Colley promulgated a similar idea. At a meeting of the Clinical Society of London in March, 1885, the secretary recorded, "Mr. Davies Colley further submitted that a similar plan might be desirable in cases of tumor of the large intestine. The loop containing the growth might be left *protruding from the wound for a few days, and then removed by knife, cautery, or some caustic agent.*" This was the first suggestion that the tumor be left *in situ* until protective adhesions develop. At the present time obstructive resection is practiced with immediate removal of the diseased bowel. Contamination, however, is avoided by keeping the cut ends of the bowel closed with clamps until protective adhesions have developed.

In 1892, Bloch of Copenhagen published work done in 1890. He brought out a tumor of the sigmoid flexure in a patient with intestinal obstruction. The proximal end was opened for the purpose of decompression. The tumor was resected several days later. After 4 months the wound edges were freed and an end-to-end anastomosis made. The patient recovered temporarily but died after 11 months from liver metastasis. This is the first reference to a case operated on deliberately by the three stage method. Bloch recorded several such cases of exteriorization of a tumor with subsequent resection and later restoration of bowel continuity. While at first he employed his method only in cases of mobile bowel, he later used this method in cases in which the colon needed mobilization. Thus to Bloch rightfully belongs the credit for first having carried out this three stage type of operation for colon resection.

In 1895, Paul of Liverpool reported in the *British Medical Journal* some work he had begun in 1892. Following an unsuccessful case he writes:

> "I, therefore, thought out and determined to put in practice the following mode of operating in the next case: First, to excise the strictured portion of bowel, as in the last two cases, then, *to suture together the cut edges of the mesentery and the adjacent sides of the two ends of the colon in such a manner that they would adhere together for about three inches in the position of the two barrels of a double barreled gun.* If this succeeded, the spur might be demolished without the slightest risk of peritonitis, and to such an extent as to insure a free passage and easy closing of the artificial anus."

Later Paul reported on 11 consecutive successful cases.

In 1902, Mikulicz described the details of an aseptic method for exteriorizing a tumor bearing segment of the bowel. The mesentery to this segment was severed and the loops were united for the purpose of building a spur. Later the tumor was removed, and subsequently the spur was broken down to restore continuity of the lumen of the bowel. He emphasized that the entire operation up to the complete closure of the abdominal cavity be carried out in an aseptic manner. The mesentery from which the tumor bearing section of bowel was suspended also was resected. This enlarged the scope of the operation.

Anschutz, a pupil of Mikulicz, pointed out that both Paul and Mikulicz demanded removal of the mesentery with formation of a spur by suturing the 2 intestinal limbs leading to the tumor and the removal of the spur by the bloodless method of crushing.

In 1903, Mikulicz visited the United States. On May 13 in Washington, D. C., at the annual meeting of the American Surgical Association, he read a paper in which he discussed the "stage" operation for large bowel resection. He stated that of 24 cases treated in stages and examined 4 years after operation, 9 were without recurrence. He continued: "Among these nine are several that have been under observation much more than 4 years. I operated on my first case 17 years ago (1886), while I conducted the clinic at Kraków."

It is apparent that the Mikulicz operation was a rather natural outgrowth of the trial and error method which has given birth to so many of our present procedures. The Mikulicz operation had its inception early in the history of colon surgery. It took more definite form as abdominal surgery became less hazardous and at the turn of the century it was established as a definite principle. Mikulicz himself did not seek credit as the author

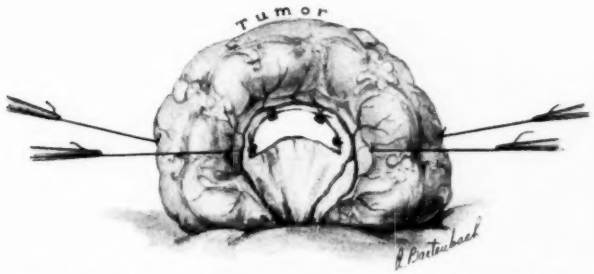

Fig. 1. Preservation of marginal vessel to site of resection. Limits of resection. Limits of resection determined and fixed by sutures placed on mesenteric and antimesenteric borders of exposed bowel (primary sutures).

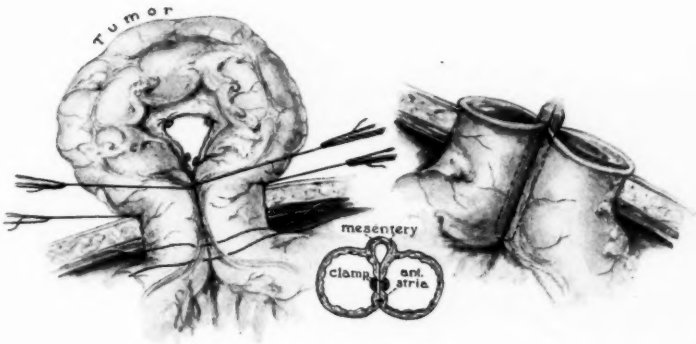

Fig. 2. Fig. 3a. Fig. 3.

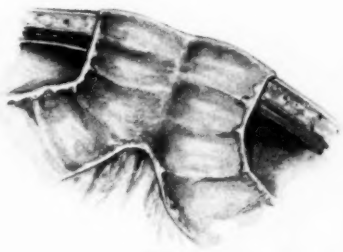

Fig. 4.

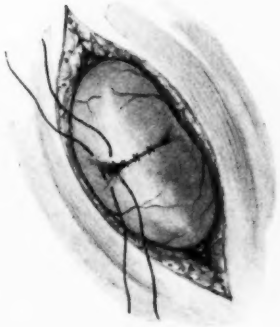

Fig. 5.

Fig. 2. Formation of spur. Longitudinal bands approximated for a distance of 3 inches when possible. No attachment of bowel to abdominal wall. Bowel may be resected by clamping at level of primary sutures. The vascularity of the stoma has been assured by the preservation of the vessels to this site.

Figs. 3 and 4. Crushing of spur with re-establishment of continuity of bowel. 3a, Note position of mesentery, site of clamp for crushing spur, and suture on anterior striæ.

Fig. 5. Eight to 10 weeks later, closure of stoma after thorough freeing from abdominal wall. Note closure made in transverse axis of bowel.

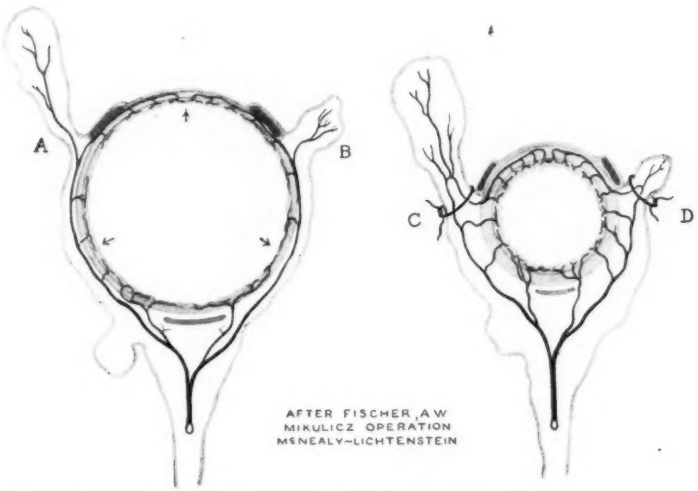

Fig. 6. Distended bowel. Slack in vessels *A* and *B* removed.
Fig. 7. Contracted bowel. Ligation of appendices epiploicæ at *C* and *D* blood supply to bowel.

of this procedure but modestly gave credit to those whose previous work pointed the way (11). The wide publicity which was given this operation by so distinguished a surgeon as Mikulicz has done much to advance this field of surgery and warrants the continued use of his name in connection with this multiple stage operation.

The success of this operative procedure is dependent upon the careful observance of the principles already established. While there are several methods that may be employed to resect the bowel according to the Mikulicz plan of operation, we wish to present some details of a method which we regard as important to avoid the dangers incident to the technical features of the operation.

OPERATIVE PROCEDURE

Exteriorization of the transverse colon and the sigmoid colon is facilitated by the presence of a mesentery to these portions of the large bowel. Other sections of the colon require mobilization by incision of the parietal peritoneum on the lateral side of the bowel wall. In 1932, Lahey gave an excellent description of the removal of the right side of the colon based on this method.

Limits of resection. Following mobilization, the limits of resection of the bowel are clearly demarcated by the application of non-penetrative sutures on the mesenteric and on the antimesenteric borders of the bowel (Fig. 1). These sutures clearly define the part that is to be removed and establish the level to which the blood supply is to be preserved. The marginal vessel is sought for and preserved while the remainder of the mesentery to the portion of bowel to be resected may be divided. While the illustration (Fig. 1) shows this division of the mesentery adjacent to the bowel, it may be possible to sever the mesentery at a greater distance from the bowel.

Formation of the spur. The spur (Fig. 2) is made by approximating the two limbs of the bowel below the level of the demarcation sutures. The longitudinal bands are approximated for a distance of at least 3 inches, preferably more when possible. The limbs are rotated toward the umbilicus away from the lateral abdominal wall so that the blood supply enters at a point remote from the site of suture (Fig. 3a).

Closure of the abdomen. No attachment of the approximated limbs of bowel is made to the abdominal wall. The peritoneum is sutured with catgut fairly snugly about the protruding limbs. The fascia is closed with interrupted catgut sutures. The skin is then loosely closed. When possible the limbs protrude through muscle bellies. This is an aid to the subsequent closure of the resulting colostomy.

Removal of the diseased section of bowel. Following careful closure of the abdominal wall, 8 inch forceps or crushing clamps are applied on both limbs of the bowel at the level of the demarcation

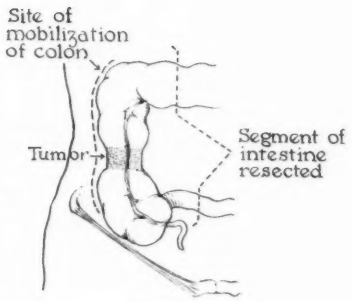

Fig. 8.

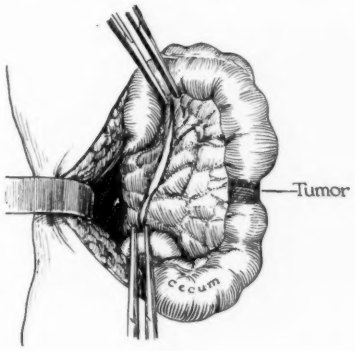

Fig. 9.

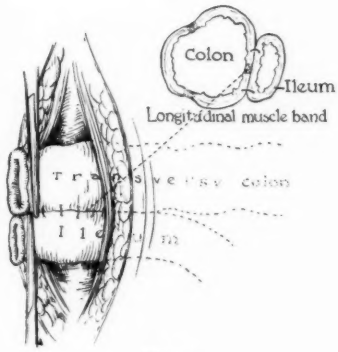

Fig. 10.

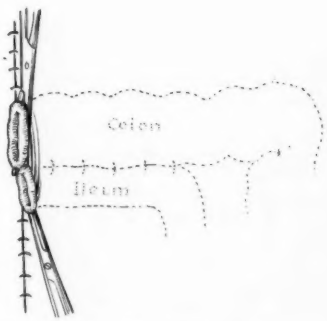

Fig. 11.

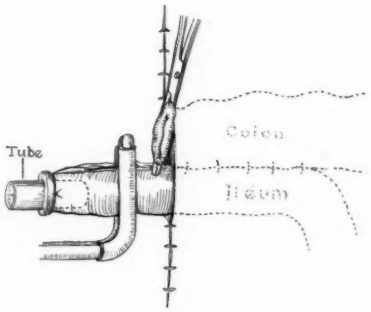

Fig. 12.

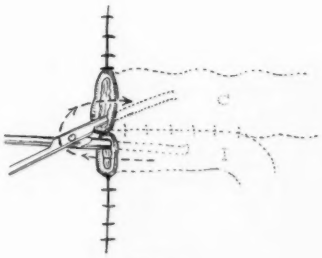

Fig. 13.

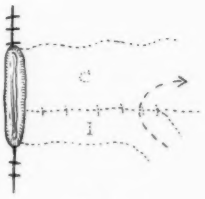

Fig. 14.

Figs. 8 to 14. Resection of the right side of the colon as described by Lahey.

sutures. The presence of these sutures makes it possible to note accurately the level to which the blood supply has been preserved. With a cautery the bowel is severed from the forceps. There is an advantage in the immediate removal of the exteriorized bowel in that the disease is removed from the body at once. However, the clamps produce a temporary obstruction. The proximal clamp may be removed within 36 to 48 hours from a portion of the bowel to permit the escape of gas. The distal clamp remains attached for a longer period to assist in holding the bowel well up in

the wound. On or about the seventh day all clamps are removed and a double barreled colostomy is present.

Crushing the spur. One week following the resection, digital examination of the spur is made and a crushing clamp is applied with one blade on each side of the spur at the site of the approximated bowel (Figs. 3 and 3a). This crushing clamp will loosen and lie free when the crushed portion of the spur has sloughed out. If some of the spur remains, it, too, is crushed until finally none of the spur remains. The patient then has a single barreled colostomy in continuity (Fig. 4).

Closure of the colostomy. After 8 to 10 weeks, during which time the abdominal wall has become immunized against the organisms present locally, the stoma is freed from the abdominal wall. This includes removal of the skin edge about the colostomy and freeing the bowel from the peritoneal attachments. The bowel is closed in its transverse axis so as not to constrict its lumen. Deep interrupted catgut sutures are placed. The seromuscular layer is approximated accurately with interrupted fine silk sutures (Fig. 5). The bowel is replaced within the peritoneal cavity. The abdominal wall is closed with interrupted sutures of braided silk passing through the full thickness of the abdominal wall.

The appendices epiploicæ have a definite relationship to the blood supply on the antimesenteric surface of the bowel (14) (Fig. 6). Those present at the site at which the diseased bowel is severed should be carefully inspected before they are removed. The placing of ligatures too closely to the base of these fatty tags may result in necrosis of a portion of the wall of the bowel.

Resection of the right side of the colon is well shown in the illustrations from Lahey. In order that obstruction may be relieved immediately following removal of the exteriorized segment of the bowel the ileum is cut at some distance from the abdominal wall and a rubber or glass tube is inserted (Fig. 12). This may be attached to rubber tubing and a container so as to avoid soiling the wound of exit. A similar plan has been described by Woodhall in the treatment of ileocecal intussusception with extensive damage to the invaginated bowel. A lateral anastomosis just proximal to the exteriorized loop of bowel prevents loss of fluids, a matter of considerable importance in infants.

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FROM THE CLINICAL SURGERY DIVISION, THE UNIVERSITY OF BOLOGNA

THE SURGICAL TREATMENT OF EXOPHTHALMIC GOITER

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EARLY intervention, generous and radical exeresis of thyroid tissue, associated with accurate pre-operative medical preparation, can be considered today as the therapeutic measures of choice for patients afflicted with the Flajani-Basedow syndrome. Close collaboration between the medical man and the surgeon, exact evaluation of the symptoms and findings by both, and the prompt substitution of surgery when medical measures prove inefficient, are the fundamental concepts which should guide us in the treatment of this condition.

The physician who gives his patient too much hope from the use of conservative measures is indeed doing a great wrong just as much so as the surgeon who believes that the only salvation for the patient is radical removal of the thyroid tissue. From the very beginning of treatment the physician must make the patient realize that eventually surgery may be necessary and likewise the surgeon must not fail to avail himself of all therapeutic and prognostic aids in arriving at his decision as to treatment.

To persist in medical therapy which, after sufficient time has elapsed, fails to show evidence of success is, in our opinion, the same as condemning the surgical treatment when it is used in a patient suffering from a severe thyrotoxic crisis before he is given proper pre-operative preparation. We never operate upon a patient suffering with the Flajani-Basedow syndrome until he has been placed in the medical ward where he may receive the benefit of the necessary pre-operative measures and where the environment permits the complete psychic rest so necessary in this disease. We never operate until the patient has received pre-operative treatment with diiodotyrosin, cardiokinetics, and sedatives and has been allowed complete rest, free from psychic excitement. The rapid pulse is corrected and the basal metabolic rate and general condition are improved.

According to the old conception, patients in grave thyrotoxic states with fever and cachexia were operated upon but operation usually was delayed, with the result that death occurred. Today intervention is considered advisable in all forms of hyperthyroidism which either are developing or are stationary and in which, after medical care, patients fail to respond. Surgery is also advised in those less grave cases in which the patient's social or economic condition does not allow him to receive proper medical care and above all when he needs physical and psychical rest.

We remove the thyroid tissue in two stages. Resection of the right lobe, which is usually most affected, is done first. After one or more months, depending on the case, the left lobe is resected. It is our practice to use this precaution to reduce the dangers of postoperative toxic conditions. This method almost always assures success in the severe forms of the disease. In our experience results were so favorable in 6 per cent of the cases that it was not necessary to remove the second lobe. After resection of the first lobe we have always observed a diminution in the neurovegetative and psychic irritability of our patients, cessation of the profuse diarrhea, and notable improvement in the basal metabolic rate—at least enough to make it possible to do the second operation under better conditions and with much less danger. The two stage operation has the great advantage of guiding us as to the quantity of thyroid tissue to excise.

While we are very generous in our resection of the right lobe, we base our judgment as to the approximate quantity of thyroid to be removed

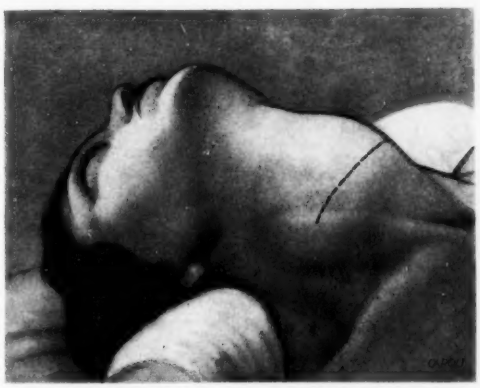

Fig. 1. The head is in hyperextension; the tie shaped incision is outlined on the anterior surface of the neck, one or two fingerbreadths above the fork of the sternum.

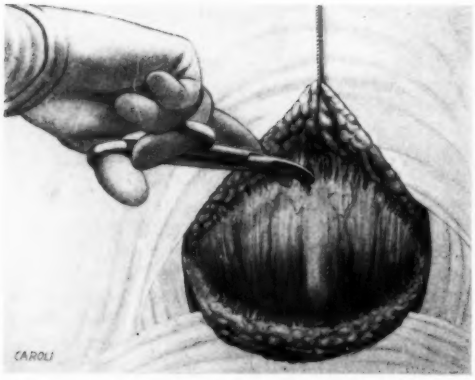

Fig. 2. With the help of the scissors the superior cutaneous limb is detached.

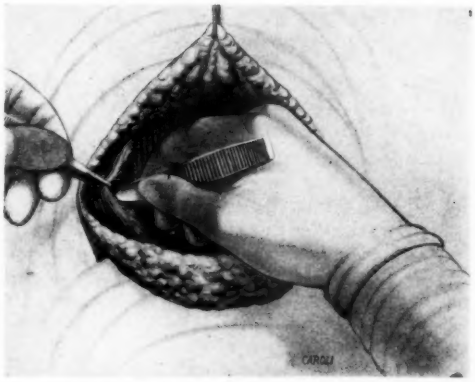

Fig. 3. The median cervical aponeurosis once cut, the sternomastoid muscles are pushed laterally.

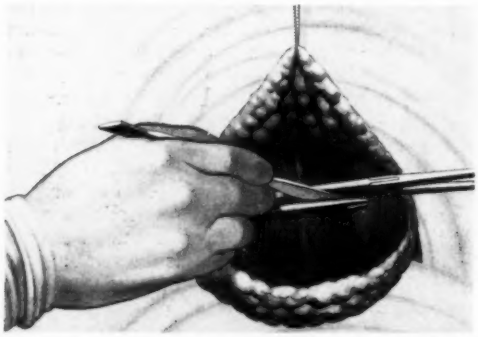

Fig. 4. The infrahyoid muscles are cut transversely between two Kocher forceps.

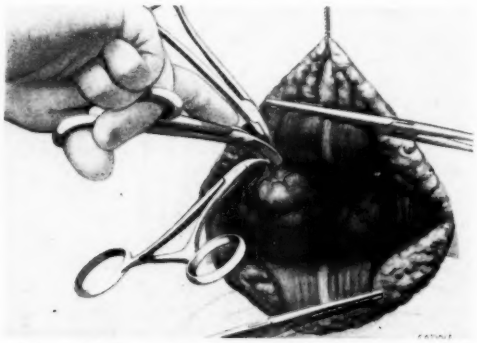

Fig. 5. Ligature and section of the superior thyroid artery and of the peduncle.

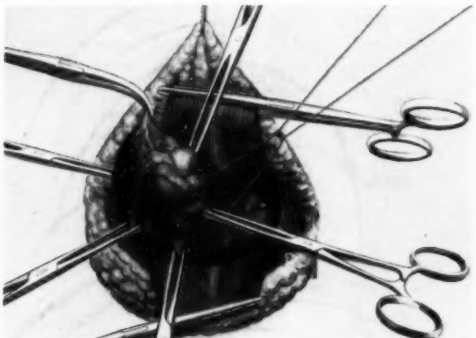

Fig. 6. A strong silk suture is applied to the base of the luxated thyroid lobe. The Chaput crown prevents its escape.

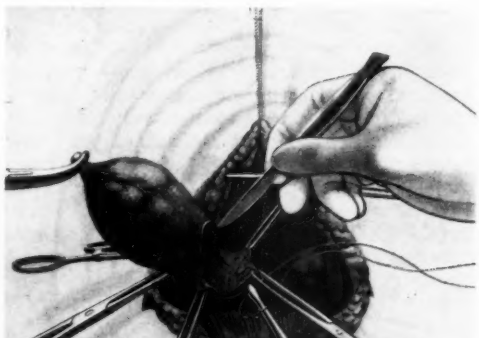

Fig. 7. The thyroid lobe is cut some millimeters above the Chaput while a strong finger forceps holds the unknotted thread.

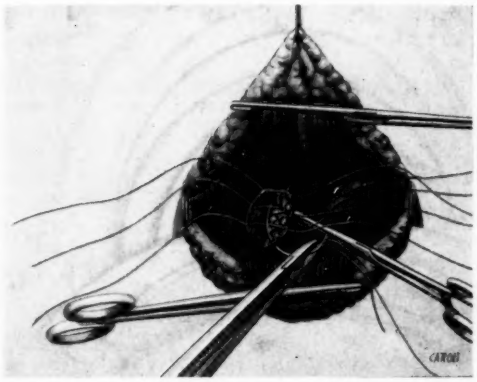

Fig. 8. Suture of the residual stump with separated catgut stitches.

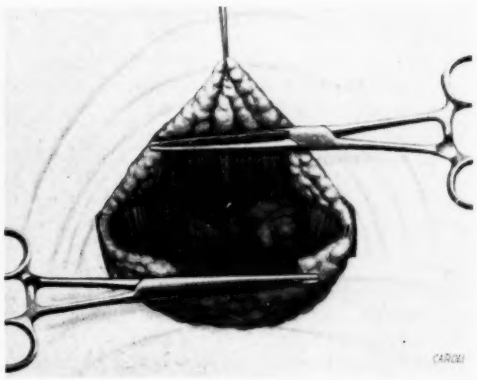

Fig. 9. The residual stump of the thyroid is sutured and the silk suture has been taken away.

from the left lobe on the residual symptoms of the patient. Our aggressiveness in the second stage, therefore, depends on the individual in question.

We prefer subtotal extracapsular resection to partial resection as this type of intervention offers distinct advantages, especially if done with the technique we use.

For the anesthetic, we use novocain administered locally, preceded by basal narcosis. This has always answered our purpose even in those forms of thyrotoxicosis in which patients are highly nervous and excitable. In fact in our patients, thanks to the use of basal narcosis, it has always been possible to suppress or calm the psychic shock and to carry out the surgical operation while they are in perfect health.

OPERATIVE TECHNIQUE

Step 1. For incision of the skin and the prethyroid muscles, the patient is placed in the supine position with the head held in hyperextension by means of a roll of linen placed under the nape of the neck. The field of operation is prepared. With the usual formality we infiltrate the skin, subcutaneous tissues, and muscular layers with novocain along the line to be incised. The novocain used contains small doses of adrenalin. In spite of the diversity of ideas regarding the contra-indications for the use of adrenalin we have always used it and have found that, rather than having a damaging effect, it is of great operative advantage. We practice the horizontal tie or cravat incision (Fig. 1) on the anterior surface of the neck, about one or two fingerbreadths above the fork of the sternum, along one of the cutaneous folds.

When the two stage operation is to be performed, that is when only one lobe is to be removed, we prefer a less extensive incision, cutting only that side on which we are to intervene. The superior cutaneous border is opened (Fig. 2) and after careful hemostasis of the cutaneous wound the deeper muscular aponeurosis appears.

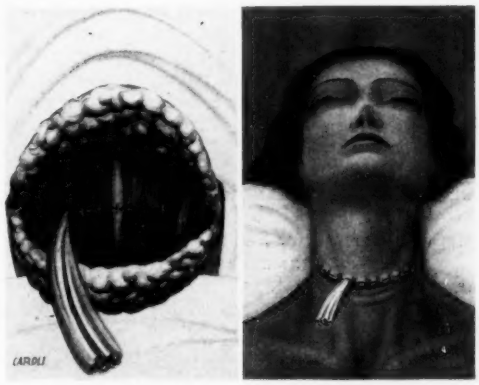

Fig. 10. Rubber drainage is shown in position site.

The medium cervical aponeurosis is incised along the sternocleidomastoid. We can then displace these muscles laterally in such a way as to traverse the infrahyoid muscles. If the thyroid is small these muscles are dilacerated in the direction of their fibers; if, instead, the goiter is large we prefer a more ample pathway and so section the infrahyoid muscles transversely by means of two Kocher forceps (Fig. 4).

Step 2. The superior peduncle is ligated and the glandular lobe is dislocated. When the thyroid gland has been uncovered, we grasp it with finger forceps and catgut suture and section the superior

thyroid artery and the peduncle of the superior lobe (Fig. 5) which is now easily visible, thanks to the previous incision. Once the ligature is made we proceed with the luxation of the thyroid lobe, releasing it with delicate digital maneuvers and using scissors when necessary.

Step 3. The lobe is resected and the hemostat suture is placed. The lobe is drawn out as far as the base, a strong silk suture, strong enough to answer the purpose of temporary hemostasis, is applied. This suture is not tied, but once constriction is obtained the lobe is held firmly with a large finger forceps until several Chaput pinchers are applied, the silk suture holding the gland parenchyma so that it does not slip.

The application of this hemostatic suture has many advantages: it permits the operator to proceed more rapidly, it protects and helps prevent injuries to the recurrent nerve and to the parathyroid glands, and above all it permits the operation to be carried out with a minimal loss of blood. Keeping a few millimeters above the Chaput pinchers the lobe may be sectioned without the loss of a drop of blood. The section includes about nine-tenths of the parenchyma of the gland.

Step 4. Suture of the residual thyroid stump and anatomical reconstruction of the walls constitute the fourth step. Once the lobe is resected, the temporary hemostatic suture is found still in place and the residual gland is sutured through and through with catgut stitches passing some millimeters from the original hemostatic suture. Generally 4 or 5 stitches are sufficient (Fig. 8). These are tied only after the Chaput pinchers and the original suture have been removed. We then proceed to ligate the separated stitches, to which a few others may be added, to the rubber drainage (we roll up a tiny piece of surgeon's glove for this purpose). If the goiter is large this drain is put in the thyroid site in close contact with the remaining lobe before proceeding with the suture of the infrahyoid muscles—if they have been cut—and the suture of the skin.

Immediately after the operation we advise that the patient be placed in the half sitting position and given no food except liquids rich in carbohydrates. Drainage is removed on the second or third day, and the cutaneous stitches are removed on the fifth or sixth day. Medical treatment to sustain the heart action and to relieve excitement of the patient is given. We generally give diiodotyrosin, 10 per cent, polybromural solution, morphine, camphoric oil, uabain, and glucose hypodermoclysis to avoid thyrotoxic complications.

The systematic use of the technique described has made it possible for us to avoid the most frequent complications after thyroidectomy. In fact we have never observed either paresis or paralysis of the recurrent nerves, we have had no cases of parathyroid tetany, and we have not experienced large loss of blood from injuries to the inferior thyroid artery. Moreover, we have never observed any thyrotoxic phenomena.

SUMMARY

We have attempted to give a description of the accurate preparation of the patient to be operated upon, to state the precautional measures of the two stage operation and the steps in technique. We have never observed in our patients, who are less than 100 in number, any notable postoperative complications. Our operative mortality is nil in spite of the fact that we have operated upon patients with high basal metabolism rates in whom the general condition appeared very serious.

In various periods since operation all our patients without exception show the benefit of operation and all claim to be completely cured (a slight exophthalmus being the only residual sign) and they all have been able to resume their regular occupations.

In conclusion it can be said that timely, generous, and radical surgical therapy can cure Flajani-Basedow disease and that it gives results far more brilliant than those attained with other methods of treatment.

CLINICAL ASPECTS OF SACROCOCCYGEAL TERATOMAS

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THE caudal region of the fetus is a favorite location for congenital deformities. Abnormalities, so situated, have been attributed now and then to fetal inclusion, the engulfing of one ovum by another. Much more frequently, however, the most plausible explanation of the defect assumes that it was caused by amniotic adhesions. In the very early stages of development the rump of the embryo comes into close proximity with the amnion. Even temporary adhesions to this membrane may invoke structural alterations in the embryo which will remain permanently, unless they are amenable to surgical treatment. Prominent among these abnormalities is spina bifida; less common are such neoplasms as lipomas, dermoid cysts, and teratomas. At times the peculiar location of the appendage, its conformation, and a covering with hair, more or less profuse, are circumstances which have led to its misinterpretation as a "true tail." Hasty observations of this kind have furnished the material for an entertaining chapter of folklore.

"The most remarkable stories have been told and have found credence; in these the significance of caudal appendages has been variously interpreted. On the one hand, a tail has been considered a distinction of the highest degree, even a mark of divine descent as in the case of the Rawas of Poorbunder; on the other hand it has usually been looked upon as a curse or a stigma of degeneration." Prof. Ross G. Harrison,[1] who has just been quoted, himself described a case of "soft tail" in a boy, prefacing his essay with an excellent résumé of our knowledge of the occurrence of tails in man. At present anatomists do not depend upon the unaided eye for the study of these growths, and the microscope has robbed them of any claim they may have had to consideration as relatives of the simian tail.

From the calculations of Calbet and Fochier, it appears that sacrococcygeal tumors of the newborn may be expected once in approximately 34,500 births. Hansmann and Berne collected 26 cases of this variety of teratomas, reported between the years 1924 and 1930. Subsequently descriptions of 46 cases have been published.[2] Further reference to the material available in the literature will be made especially in connection with the question of treatment, an important problem in spite of the fact that surgeons do not have to face it very often. One-fifth of these infants are stillborn in consequence of difficulties in their delivery; others, born alive, perish during the early days of the postnatal period.

[1] Johns Hopkins Hosp. Bull., 1901, 12: 96–101.

[2] A detailed tabulation of the 46 cases collected from the literature since 1930 will be included in reprints of this report.

CLINICAL STUDY

Girls predominate among the infants afflicted with sacrococcygeal teratomas; of 59 cases in which the sex was specified, 13 were males, 46 females. Typically, the tumor is located between the rectum and the lower segments of the vertebral column. It may be deeply buried and project slightly, if at all, beyond the surface of the body, but the occult variety is quite infrequent. The existence of a deformity was obvious upon external examination at birth in 65 of the 72 cases recorded since 1924. In any event it becomes imperative to learn as far as possible by rectal touch to what extent the growth has penetrated in the direction of the pelvic cavity. It is generally found, however, that the neoplasm has followed the path of least resistance, outwardly, to form a mass varying in size and shape in different cases, and lying free between the lower extremities of the child. The area of external attachment is limited to the region of the sacrum and coccyx. In some instances the anal orifice lies upon the anterior border of the tumor, just below its junction with the perineum. The mass may extend posteriorly, to right or left, displacing the gluteal muscles.

The cutaneous surface of the tumor, of variable thickness, becomes quite thin in certain spots to which fragments of bluish membrane often adhere. Hypertrichosis is observed frequently. The presence of fistular tracts, with or without drainage, is exceptional. On palpation it becomes clear that the mass consists of intermingled solid and fluid compartments.

PATHOLOGY

Exhaustive microscopic surveys of long series of sacrococcygeal teratomas by Nicholson in 1929 and more recently by Willis have detected tissues that corresponded with almost every organ of the body; representatives of the kidneys and gonads were not identified. Willis laid stress upon his

Fig. 1. Infant prior to operation.

observation that derivatives of each germ layer are usually clumped together, even though their arrangement be quite disorderly. He also remarked among the specimens at his disposal a progressive gradation from relatively simple neoplasms containing rather indefinite embryological anlage to other abnormalities affording good examples of ischiopagia. These architectural variations, the intricate histological pictures presented by the tumors, their location at a point where several forces act to mold the embryo, and still other pertinent facts have provided good excuse for the multiplicity of hypotheses advanced to explain the origin of sacrococcygeal teratomas. An elaborate account of these theories has been given by Rosedale.

DIAGNOSIS

It becomes a matter of practical importance to differentiate these tumors from spina bifida. For this purpose very simple tests are applied preliminarily. Communication with the spinal canal should be ruled out whenever the mass is incompressible and when squeezing it does not cause the anterior fontanelle to bulge. Again an impulse is transmitted to a spina bifida, if the infant cries, or coughs; whereas the impulse will fail of transmission in cases of sacrococcygeal teratomas. Roentgenological examination, of course, will assist in reaching a diagnosis, especially when masses of bone appear in the structure. In one instance the injection of lipiodol into the spinal canal was employed. Aspiration of cystic areas in the tumor has been practiced, and even more significant evidence of their contents becomes available whenever cysts rupture during the course of birth. Sebaceous material and hair always establishes the teratoid character of a growth. In a few instances the eventual demonstration of well defined bowel has warranted the interpretation of the tumor as a fetal inclusion. A similar conclusion was reached by Ballantyne[1] who observed, "A female infant with a large tumor attached to the postanal region which when examined by the roentgen-rays was found to contain a spinal column and ribs; obviously, this was not a tail but an attached twin or parasitic fetus."

RESULTS OF SURGICAL TREATMENT

Among the 72 cases analyzed for purposes of this report, 14 infants were stillborn, 11 died within a few days of birth, 45 came sooner or later to operation and in 2 described sketchily the clinical details were omitted. Whenever the infant survives, the deformity alone provides ample indication for surgical intervention. Even more urgent reasons for prompt excision relate occasionally to the pressure of the tumor upon neighboring organs, causing for example an obstruction of the bowel or hindrance to the passage of urine. And,

[1]Antenatal Pathology: The Embryo, p. 321. Edinburgh, 1904.

Fig. 2. Infant following operation.

significant indeed is the fact that malignant changes in the tumor were observed in nearly 9 per cent (6 instances) of the cases reported since 1924. The ages of 44 patients in the group reported since 1930 were a year or less in 28 cases, half of them being not over a month. Four operations were performed upon patients between the first and second years; 6 were between 4 and 18 years; and 6 between 20 and 60 years.

Complete excision of the tumor becomes a simple matter, if it is superficial, attached to its base by a slender pedicle. On the other hand, the technical difficulties which challenge the surgeon are more than ordinary whenever the growth extends into the pelvis, and satisfactory exposure requires removal of the coccyx as well as part of the sacrum. The steps in this procedure have been described admirably by Pearse. Tapping or partial removal of the tumor has proved to be ill-advised; too often the sequel has been infection and a chronic fistular discharge. The therapeutic value of radiation has not been fully ascertained, but in all probability is limited to those cases in which evidence of malignancy has been found.

Of the patients who received surgical treatment since 1930, 57.7 per cent recovered (26 cases). In 8 other instances nothing was said of the end-result. Eleven patients (24.4 per cent) died. With respect to the outcome of surgery at different periods of life recovery was announced in 64 per cent (9 cases) when the operation was performed during the first month of infancy; and in 57 per cent of 14 additional cases operated upon during the first year. Between the first and the eighteenth year 7 of 10 patients survived, whereas only 2 recoveries followed operation upon 6 patients between 20 and 60 years of age.

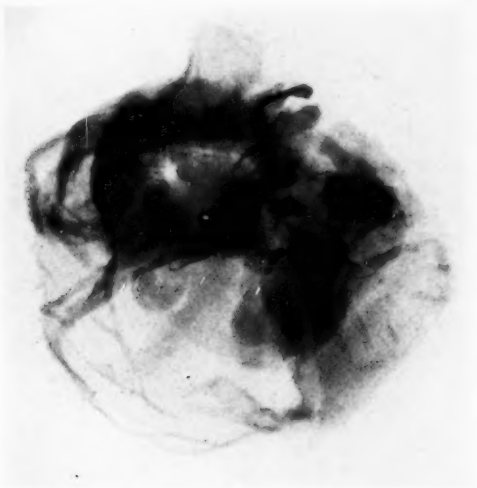

Fig. 3. Roentgenogram of excised tumor.

Upon statistical grounds, no less than for reasons fairly called humanitarian, the complete excision of sacrococcygeal teratomas should be undertaken at an early age, preferably during the period of infancy. Even if the tumor is small and at the time without any appearance of malignancy its excision should be recommended to eliminate a source of future discomfort and embarrassment.

REPORT OF CASE

A white female infant was seen in consultation with Drs. R. D. McBurney and D. C. Shelby at the Cedars of Lebanon Hospital, February 22, 1935, 5½ hours after its birth.

The mother gave a history of a previous pregnancy ending in the birth of a normal infant. The pregnancy just concluded had also been normal and the labor with the fetus presenting by the vertex had advanced without complication until the head reached the perineum. A mediolateral episiotomy failed in its purpose and Dr. McBurney used the obstetrical forceps to effect delivery. Then it became clear that the dystocia was due to a sizable tumor attached to the body of the infant. Its birth weight was 8 pounds. The placenta and membranes were normal.

The infant was a well developed female presenting a tumor mass in the sacrococcygeal region, extending 2 inches dorsally from the posterior margin of the anus in the midline, and extending laterally 2 inches over either buttock. From this attachment, the tumor expanded as an irregular nodular sac measuring 5 inches in diameter. The tumor was covered with normal skin except over the coccyx and in two other areas where the covering was a thin, bluish membrane. Palpation demonstrated cystic and solid portions, with irregular hard masses in the depths. There was no bulging of the fontanelles upon local pressure over the tumor. Rectal examination revealed that the tumor was superficial, and a soft rubber catheter passed with ease into the rectum for a distance of 6 inches. There was no obstruction to micturition. X-ray examination demonstrated

Fig. 4. Stratified squamous epithelium with glands.

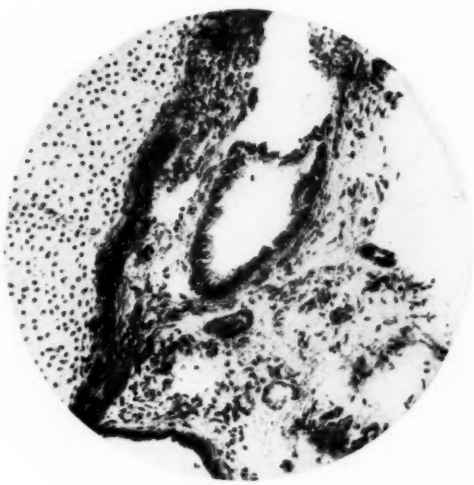

Fig. 5. Bronchus-like tissue.

irregular calcific deposits at the isthmus of the tumor and showed that the lumbar vertebræ and sacrum were of normal configuration. As no other abnormality was evident, the pre-operative diagnosis was congenital sacrococcygeal teratoma. *Operation* was performed the following day, using novocain (1 per cent) local anesthesia. An incision was made in such a manner as to leave sufficient normal skin flaps to cover the area of attachment after the tumor had been removed. Dissection was carried down toward the sacrum and coccyx until these structures were reached. Several small masses of bone were encountered and removed. The tip of the coccyx was exposed and found to point posteriorly instead of anteriorly, and, therefore, a portion was removed. Closure was made without tension, by means of fine black silk sutures. One rubber dam was placed near the middle of the incision and sutured to the skin. During the operation the baby vomited several times when traction was applied to the mass. At the close of the operation she was in a state of moderate shock. An immediate transfusion of 100 cubic centimeters of whole blood was given by Dr. Roy Hammack, following which her condition improved.

The postoperative course was uncomplicated. The drain was removed on the second day; a small amount of serous drainage followed. There was no fever, except upon the sixth and seventh days when the temperature reached 100 degrees F. The infant gained at a normal rate from a weight of 7 pounds immediately after the operation to 8 pounds 2 ounces when discharged from the hospital 19 days later.

Pathological examination of the excised tumor was made by Dr. C. M. Hyland. The specimen measured 10.5 by 8 centimeters. The external surface was covered by epidermis in which a few long black hairs were noted. About the middle of the surface there were two buds of tissue 1.5 centimeters in height, separated by a like distance; one of these somewhat resembled a clitoris, but on cut section was found to consist of gland-like tissue. At one edge of the specimen there were noted a number of small grape-like masses filled with white mucoid material. On palpation fluctuant and solid portions were noted, with irregular bony masses in the interior which are shown in an x-ray picture of the specimen. On cut section it was noted that a large portion of the mass was made up of a cavity filled with clear yellow fluid. The wall in the region of the attachment of the tumor was approximately 2.5 centimeters in thickness, but thinner in the neighborhood of the two buds of tissue noted externally thus permitting an outpouching of the cavity, which contained a yellowish cord-like structure. The lining of the large cystic cavity was similar to epidermis in gross appearance. Some recent hemorrhage into the tissue was probably due to trauma during excision.

Microscopic examination revealed various histological configurations representing derivatives of the three primary

Fig. 6. Tubular tissue with adrenal-like tissue.

germ layers. The inner surface of the cystic cavity was lined with stratified squamous epithelium in conjunction with well developed hair follicles, sweat glands, and sebaceous glands.

Sections from the structure which grossly suggested a clitoris showed a lumen lined with epithelium similar to that of the esophagus. Tissues resembling cardiac and voluntary muscle were noted. Both cartilage and bone were present. In one place there were cavities lined with ciliated cylindrical epithelium, with smooth muscle and plaques of cartilage, so that the structure as a whole closely resembled a bronchus.

In one area the tissue was made up of small closely packed tubules lined with columnar epithelium; however, no glomerulus-like structures were found. In addition, these sections showed small islands of large cells with clear cytoplasm similar in appearance to the "foam cells" of the adrenal.

Representations of nervous tissue consisted for the most part of glial cells, but well developed nerve fibers also were identified.

Pathological examination confirmed the diagnosis of sacrococcygeal teratoma.

SUMMARY

Infants are not often born with sacrococcygeal teratomas; and among those so afflicted stillbirth or death soon after the birth reduces substantially the number of cases which require clinical consideration. Differentiation of the tumor from spina bifida seldom offers difficulty. The deformity, of itself, always warrants surgical intervention even in the absence of complications, like visceral obstruction, and without references to the possible development of malignancy. Upon statistical grounds, no less than for humanitarian reasons, complete excision should be undertaken during early infancy, occasionally on the day of birth.

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THE CONSERVATIVE TREATMENT OF DIABETIC GANGRENE

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ONE of the most difficult problems in the treatment of diabetic gangrene has been the control of spreading infection of the foot and leg. Incision and drainage of infected areas with the application of wet dressings of boric acid or other standard solutions have been the accepted procedures heretofore but with disappointing results in the majority of instances. Time after time high amputation of an extremity in a diabetic patient is performed because of uncontrollable infection, even in cases with fairly adequate circulation and a minimum amount of gangrene. Every surgeon is familiar with this situation.

Increasing experience with a new and remarkably efficient chlorine antiseptic, azochloramid (1, 3, 4), has given results apparently unobtainable heretofore by orthodox methods in the control of diabetic infections. The following points must be emphasized as essential to success by this method:

1. Every area of so called "dry" gangrene in a diabetic extremity is a potential source of fatal infection.

2. Areas of established infection with pus formation must be immediately and adequately incised and laid wide open.

The terms "dry" and "wet" gangrene are so indefinite and smack so much of the medieval "humors" that they should be discarded from the scientific nomenclature of the vascular diseases. A gangrenous area, whether it be a toe or part of a foot, may be mummified so completely as to create the false impression that it is sterile. Cultures of these areas, however, particularly of the region of the line of demarcation, will reveal the presence of saprophytic organisms. When to this is added the contamination of bedding, flies, etc., when such extremities are treated by exposure under a heated cradle, the possibilities of infection are increased enormously. To minimize the chances of secondary infection in a so called "dry" gangrenous area it is advisable to apply a dressing of gauze saturated with 1:500 azochloramid in triacetin in such a way that the gangrenous portion and the adjacent healthy parts are thoroughly covered. Over this a protective dressing of dry gauze is applied, followed by a suitable bandage. Dressings may be changed every other day. It is important that careful technique be employed while changing dressings. Handling the gangrene or other parts of the foot with uncovered fingers is dangerous; sterile gloves or instruments are obligatory. Contact with blankets, moreover, is to be avoided particularly because of the possibility of gas bacillus infection from this source.

After the line of demarcation has been established careful separation of the gangrenous parts may be attempted with a sharp pointed scissors as much as possible on the gangrenous side of the line. Several sessions without anesthesia may be necessary to effect complete severance. After each manipulation it is very important that the opened areas be thoroughly packed with gauze saturated with a 1:500 solution of azochloramid in triacetin. If, for instance, a toe has been removed by this method, the stump must be completely covered, paying particular attention to the region of the cut flexor and extensor tendons. Before the use of azochloramid these cut tendons were the danger points in the conservative treatment of diabetic gangrene. It was almost a foregone conclusion that as soon as the tendons, particularly of the plantar surface, were cut in removing a gangrenous toe, immediate retraction of the proximal end into the tendon sheath would carry infection into the deep plantar tissues resulting in ultimate amputation of the leg. However, with careful application of azochloramid packing to the stump of the toe, making sure that the gauze is forced into the tendon sheath, the possibility of spreading infection is greatly lessened.

After removal of the gangrenous toe the stump is dressed daily by first irrigating with Dakin's solution or a 1:3300 solution of azochloramid in saline or a 0.5 per cent chloramine solution. The usual packing with 1:500 azochloramid in triacetin is then applied followed by a protective dry dressing. This routine is continued until all slough is removed and the stump is filled with healthy granulations. When all signs of infection and slough have disappeared, the granulating stump

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Fig. 1, left. Case 1. Aged 60 years. Infection originating in corn at base of small toe, spreading along transverse fold at base of toes, causing secondary gangrene of second toe. Complete healing with spontaneous separation of gangrene. Oscillometric index at right ankle 9.0.

Fig. 2. Case 2. Aged 40 years. Diabetic infection originating in callus on sole of foot, spreading to middle toe and up on dorsum of foot, causing secondary gangrene of toe. Completely healed. Oscillometric index at right ankle 7.0.

Fig. 3, above left. Case 3. Aged 57 years. Severe gas-forming infection arising in second interdigital space, spreading to dorsum of foot, with secondary gangrene of toe. Infection spread further into deep plantar tissues, requiring extensive incisions and packing with azochloramid. Oscillometric index at right ankle 12.0.

Fig. 4, above center. Case 3. Infection spreading along transverse fold at base of toes.

Fig. 5, above right. Case 3. Complete healing with amputation of gangrenous second toe.

Fig. 6, below. Case 3. Complete healing of dorsal infection.

may be dressed with a bland ointment such as boric acid until complete healing has occurred.

SITES OF INFECTION

Diabetic gangrene with established infection requires careful observation and knowledge of the usual routes of spread of the infectious process in the foot. The most common points of origin of infection in diabetic feet are: (1) an interdigital fissure due to epidermophytosis; (2) a corn on the dorsum of the toes particularly the small toe; (3) a callus on the plantar surface of the foot; and (4) secondarily infected blebs or gangrenous areas following burns produced by baking lamps or heating pads.

Infection originating in an interdigital space may spread up on the dorsum of the foot usually for a distance of about 1 to 3 inches. This is a very common location for diabetic infection and one of the easiest to control because of the comparatively simple arrangement of tendons in this location. Careful palpation will usually elicit the site of pus collection which must be opened immediately and widely, and the resulting cavity thoroughly washed out with boric acid or Dakin's solution. Local infiltration or freezing anesthesia should never be attempted in this type of patient because of the danger of devitalizing the tissues. Gas anesthesia is sufficient, or in most cases one quick cut can be made with a sharp straight scissors without the use of any anesthesia whatsoever. The cavity is then packed thoroughly and tightly as for a hemorrhage with plain packing saturated with azochloramid in triacetin. A dry dressing is applied and the foot redressed every day. If in addition to the localized pus infection there is a lymphangitis extending up the leg, it usually will be found that upon proper incision and packing as here described the lymphangitis will subside after 24 to 48 hours.

The next most common path of infection in diabetic gangrene is from the base of any of the toes along the flexor tendon sheath into the deep plantar tissues. If the infection originates at the base of any of the 4 small toes of the foot, it usually tracks its way to the neighborhood of the big toe. Such an infection can be diagnosed easily by careful pressure along various parts of the sole of the foot; at the same time it should be noted whether or not pus can be expressed from any opening that may be present. Expression of pus from the base of any toe by pressure at a distant point indicates a purulent pocket con-

Fig. 7, left. Case 4. Aged 56 years. Diabetic infection originating in first interdigital space with secondary gangrene of second toe. Infection spread to dorsum of foot. Oscillometric index at left ankle 3.0.

Fig. 8, left center. Case 4. Spread of infection along transverse plantar fold.

Fig. 9, center. Case 5. Progress of healing.

Fig. 10, right. Case 5. Completely healed.

nected with the opening and situated at the point of pressure. A grooved director must be inserted along the infection tract until its point can be felt beneath the skin in the deeper tissues. In some instances a tract 3 to 4 inches long and about an inch deep may thus be explored. The grooved director is left in position and one blade of a sharp pointed, straight scissors is inserted from the original opening to the depth of the grooved director. As a rule no anesthesia is necessary. With one quick cut the entire tract is laid wide open down to its furthest depths. If there are 2 or 3 side tracts connected with the main channel, these must be slit open in the same manner. The pus is washed out and the tract packed widely and thoroughly with particular care that no dead spaces are present. Plain packing saturated with azochloramid in triacetin is used.

A third path of infection in diabetic gangrene is a transverse route across the base of the toes on the plantar surface. This must be incised with a straight scissors transversely, and care should be used to make sure that every small adjoining pocket is thoroughly evacuated. Again irrigation and packing are carried out. These 3 locations, dorsum of the foot, deep plantar tendons, and the transverse fold along the base of the toes, are the 3 most common routes of infection in diabetic gangrene of the feet. The 3 incisions described will be found to be adequate for any of these types of infection.

For a few days after the incision has been made, daily dressings consisting of irrigation with boric acid or Dakin's solution followed by thorough packing with azochloramid gauze are carried out. Particular care must be paid to careful palpation of tissues adjacent to the lines of previous incision to detect new pockets of pus. If such are found, they are to be split open immediately, irrigated, and packed in the usual way. After a week or 10 days it usually will be noted that there are no new extensions of infection. If such is the case, dressings may now be changed every other day. At no time should wet dressings be used. If the patient's temperature is normal or below 100, it is best to carry on treatment with the patient in a wheel chair rather than in bed. The affected extremity, however, must be kept in the horizontal position at all times. It will be found usually that with adequate incision of infected areas the diabetes comes under control more easily and the need for insulin drops considerably.

Meticulous attention to all details is essential when these cases are dressed. After a few weeks, gangrenous areas and sloughing tendons may be easily separated and removed. At about this time healing granulations begin to appear in the depths of the incision. Quite often a large piece of sloughing tendon will cause considerable purulent excretion in the depths of the wound. This is not to be confused with the formation of a new pus pocket. If such a sloughing tendon is found, it should be gently removed provided it is thoroughly macerated. The same routine of irrigation and firm packing is continued until all slough and gangrene have been removed and granulations have completely filled the incised area. Epithelization follows rapidly thereafter.

Success with this type of case is dependent to a great degree upon the status of the collateral circulation in the extremity, since the underlying vascular change is due to arteriosclerosis obliterans. For determination of this point, an oscillometer is indispensable and yields information that can be gained in no other way. In 1929, Silbert and I observed that an oscillometric read-

Fig. 11, left above. Case 6. Aged 66 years. Diabetic infection arising in plantar callus; tendon sheaths laid wide open. Oscillometric index at right ankle 4.0.

Fig. 12, left center. Case 6. Partial healing with secondary gangrene of second toe.

Fig. 13, left below. Case 6. Extension of infection to dorsum of foot.

Fig. 14, right. Case 6. Completely healed.

ing of zero at the ankle usually indicates a bad prognosis in gangrene due to thrombo-angiitis obliterans. A reading of 0.5 or more at the ankle on the other hand is usually indicative of a fairly good collateral circulation. This observation may be utilized in diabetic gangrene in about the same manner; namely, an oscillometric reading of zero at the ankle in diabetic gangrene with infection indicates very little chance for successful conservative therapy. However, a reading of 0.5 or more at this level means that conservative control of the infection even in the presence of gangrene should be tried along the lines indicated above.

It is a strange fact that in many instances even with a good oscillometric reading an infection originating in a callus, corn, or interdigital space may produce secondary gangrene of one or more toes after a period of a week or 10 days. This may occur in diabetics in their early 30's, who without infection probably would not develop gangrene

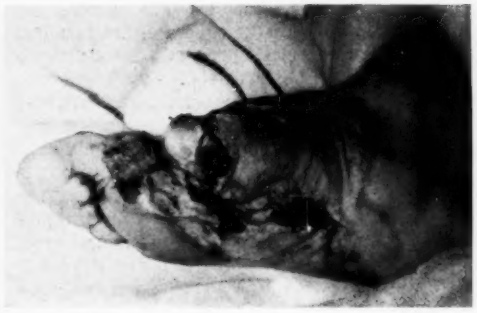

Fig. 15. Case 7. Aged 48 years. Uncontrollable infection and gangrene. Oscillometric index 0. Amputation above the knee. Primary union.

at all. This type of gangrene, secondary to infection in extremities with good oscillometric readings, is of a benign type and should not cause undue alarm. The extremity with a zero oscillometric reading at the ankle and primary gangrene complicated by a secondary infection presents quite a different problem. Although conservative therapy may be tried here with the same technique, it is usually unsuccessful because of the rapid spread of gangrene to important weight-bearing portions of the foot with no tendency or indication of healing or granulation. Such a "zero" foot requires amputation through the lower part of the thigh according to the technique described elsewhere (2). The extremity with an oscillometric reading at the ankle of 0.5 or more with either infection or gangrene or both to such extent that the weight-bearing portion of the foot appears to be completely destroyed may also require amputation but of a different type.

For this form of diabetic gangrene the following operative technique has proved successful in my hands. A circular incision is made about 8 inches below the lower border of the patella through skin and soft tissues down to the tibia and fibula. The incision is extended proximally for about 3 inches down to the lateral surface of the fibula, the muscle planes being separated gently until the bone is reached. With a Gigli saw the fibula is removed at the upper and lower limits of the longitudinal incision. The operative field is now similar to that encountered in operations above the knee. The soft tissues are gently retracted proximally and the tibia is sawed through about 2 inches proximal to the level of the circular skin incision. By this technique the fibula is removed about 1 inch higher than the tibia. The sharp anterior ridge of the tibia is beveled off with

either a saw or bone forceps. The muscles are sewed over the end of the tibia and are fastened to the fascia anteriorly. The incisions are sewed with careful approximation of skin edges. To avoid reactions in the tissues silk instead of catgut is used throughout both for ligatures and sutures.

As a rule the patient may be out of bed a day after the operation, in a wheel chair. Sutures may be removed on the fifth or sixth day and the patient sent home in 8 to 10 days. No tourniquet is used and cyclopropane anesthesia is preferred. With an oscillometric reading of 0.5 at the ankle and with careful technique primary union should be obtained routinely.

SUMMARY

In the diabetic patient gangrene differs from thrombo-angiitis obliterans in that infection plays a very great rôle.

Infection in diabetic gangrene, heretofore an almost certain indication for amputation, can be satisfactorily controlled with the use of a new chlorine antiseptic, azochloramid.

An oscillometric reading of 0.5 or more at the ankle level indicates a favorable chance for success of conservative therapy. If amputation is necessary in this type of case, it may be performed below the knee with excellent results by a new and simpler technique.

In the "zero" case, amputation, if required, must be done through the lower third of the thigh, silk is used for ligatures and suture, and the stump is closed without drainage.

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REPAIR OF LARGE DEFECTS AFTER REMOVAL OF CANCER OF THE LIPS

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SMALL carcinomas of the lip may be excised by the classical V incision without deforming the lip (Fig. 1). The larger the lesion, the wider must be the V and the lower the apex of the V. This operation is not satisfactory for lesions over 2 centimeters in diameter, for it makes the lip so narrow that the performance of secondary procedures may be necessary.

A method for *total* restoration of the lower lip by using flaps from the nasolabial folds has already been described by the writer.[1] This operation gives a satisfactory result from the cosmetic standpoint. However, the new lip is devoid of muscle and serves only as a dam for food and saliva.

The problem discussed in this paper is that of reconstruction of the lip when from one-third to two-thirds has been removed. The operation often described consists in making lateral incisions from the commissures and parallel incisions from the lower edge of the defect outward and in moving a skin and muscle flap directly inward. This gives a tight and awkward lower lip and a redundant and overhanging upper lip, because the orbicularis has been divided on each side and its function has been destroyed.

The orbicularis oris is a muscle or group of muscles which encircles the mouth, passing from one lip to the other (Fig. 2). Fibers of other muscles of the face, anchored on the upper and lower jaws, pass into and help make up the orbicularis oris. Practically, it may be considered as a circular muscle suspended by muscular fibers. The muscles on either side of the mouth exert sufficient pull to make the mouth a horizontal slit, the commissures being the ends of the slit. It is important to realize that the union of the mucous membrane with the skin is the same on all portions of the upper and lower lips and is no different at the commissures. Because of these facts the position of the commissures may be changed at will by altering the muscle pull.

From the Plastic and Tumor Clinics, Massachusetts General Hospital, Pondville Hospital and Westfield Sanatorium (Cancer Section) (Massachusetts Department of Public Health) and the Collis P. Huntington Memorial Hospital.

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We have not been satisfied with any operation that interfered with the function of this muscle and that left not only a useless segment of muscle in the upper lip, but also fragments of functionless muscles in the lower lip. Such a result is similar to that seen in the rectal sphincter when multiple incisions have been made. It occurred to us that the orbicularis oris and the commissures could be rotated. Would not a small mouth with normal musculature be better than a large mouth with no function of the lip? While we were contemplating the possibilities, a man with a particularly large mouth and with a wide, superficial low grade carcinoma consulted us and the operation about to be described was performed. The result was very satisfactory and we have now used this method in 23 cases. It is equally satisfactory in either the upper or lower lip.

TECHNIQUE OF OPERATION

The lesion on the lip is excised with a wide margin (1 cm.) of normal tissue (Fig. 3). The incision is made rectangular in shape and extends down to the fold between the lip and the chin. The corresponding mucous membrane is also removed, but it is not necessary to remove so much as is removed from the skin. The mucous membrane is separated from the muscle and skin for a distance of about 2 inches out on the cheek. (In dissecting up a mucous membrane flap it is always desirable to save as much fat on the mucous membrane as possible to insure a good blood supply.)

Incisions are made for a distance of 2 to 3 centimeters laterally from the lowest part of the defect. These incisions lie just below the orbicularis oris. Curved scissors are inserted in the wound and with the scissors curved with the muscle, any fibers from the adjacent muscles are divided up to about one-half inch above the level of the commissure. Bleeding is checked by a temporary pack, but care must be used not to divide the facial artery.

It is now possible to close the defect. Since we have separated the mucous membrane from the muscle, we can now exert a medial pull on the mucous membrane and a rotary pull on the muscle and skin. The mucous membrane is sutured from the gingival margin to the vermilion border with

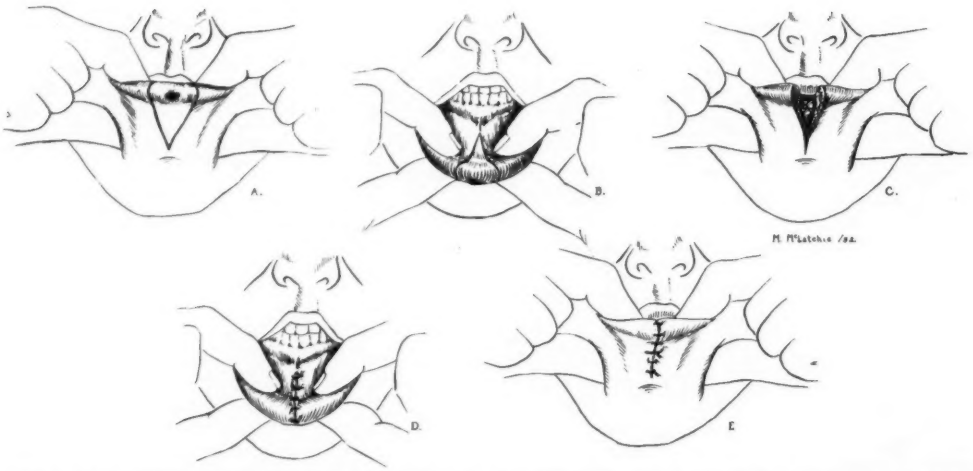


Fig. 1. The V excision for carcinoma of the lip. A, The external incision has been carefully marked out; B, the incision made into the mucous membrane is shown; C, the V has been removed; D, closure of the mucous membrane has been accomplished; E, closure of the skin has been carried out.

No. o chromic catgut, with the knots free in the buccal cavity (never between the muscle and mucous membrane). Special care is taken to suture the muscles carefully with deep sutures of No. o chromic catgut, usually three in number. The skin is approximated with silk. This makes a very tight closure of the lip. Below the horizontal incisions the skin is redundant and it is wise to remove one or two small triangles from it. It is then possible to close the horizontal wound. A pressure dressing is applied for a few hours and then the wound is left exposed to the air.

The appearance of the patient as the operation is finished is almost alarming. The lip is so tight that it looks as if the suture lines could not possibly hold. The commissure has been rotated but does not look right. However, by the following day the tension has lessened, the patient can take liquid nourishment and one's fears are quieted. By the third or fourth day the lips have become equalized, a new commissure has formed and the patient can eat solid food. The patient is encouraged to place his tongue against the new lip at frequent intervals to exert a little pressure

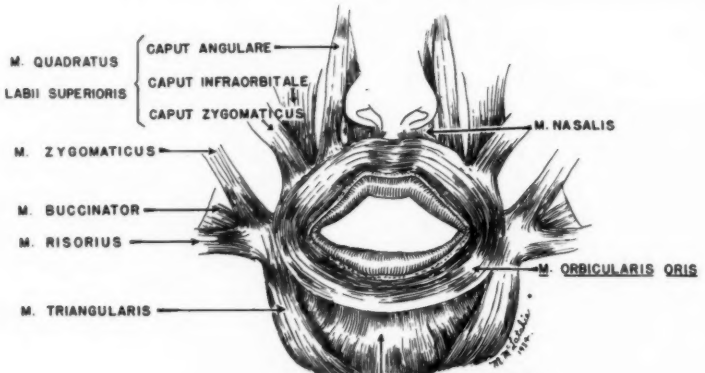


Fig. 2. The muscles of the mouth (somewhat diagrammatic). The shape of the mouth is determined by the pull of the muscles and can be changed at will.

TABLE I.—RESULTS OF TREATMENT IN CARCINOMA OF THE LOWER LIP—17 CASES

	Cases
Died of other causes, without recurrence	3
Available for study, 14 cases:	
Died of recurrence in neck, 1 year	1
Local recurrence, secondary treatment, well 4 months, 2½ years	2
Well 4 years	1
Well 3 to 4 years	5
Well 2 years	1
Well 1 year or less	4
Total	17

TABLE II.—RESULTS OF TREATMENT IN CARCINOMA OF THE UPPER LIP—6 CASES

	Cases
Well 4⅓ years	1
Recurrence after 2⅓ years, well 3 months after second operation	1
Nose, antrum, and orbit also involved, well 4½ years	1
Nose and upper jaw also involved, recurrence in upper jaw controlled, no recurrence in lip 3½ years	1
Face also involved, recurrence did not respond to treatment	1
Inoperable metastases in neck at time of operation, plastic failure	1
Total	6

on it. The stitches are removed on the sixth or seventh day. Gradually the mouth stretches out to nearly normal size.

When the defect is not too great or when it is located on one side of the lip the operation described is not necessary and a single plastic procedure can be carried out. In that case the rotation of the commissure is accomplished from the side opposite the defect.

The orbicularis oris is innervated by the facial nerve. Because of the multiple origins of the fibers which make up the nerve, the cutting of a few fibers does not seem to interfere with the innervation. This was proved by the first patient in our series who could whistle normally a few days after the operation.

TREATMENT OF THE LYMPH NODES OF THE NECK

It was formerly our belief that any carcinoma of the lip, removal of which leaves an extensive defect, is quite certain to metastasize to the lymph nodes of the neck. However, metastases have been rare in this series. The very fact that these patients had large lip lesions but did not have extensive metastases has automatically made this a group of selected cases. For this reason, no inference should be drawn that lesions which become large locally do not tend to spread to the nodes.

In many instances enlarged nodes are inflammatory and they will disappear after the ulcerated lesion of the lip has been removed. If nodes are palpable after a brief interval and if they are not adherent to deep structures we believe that they should be removed at a secondary operation. We advocate a bilateral dissection of the upper neck in one or two stages, the dissection being carried out from one sternomastoid to the other, upward to the tip of the parotid, downward to the level of the bifurcation of the carotid, and medially from the hyoid bone up to the mandible. The physical condition of the patient will contra-indicate such a procedure very rarely. These dissections are easily carried out under local anesthesia, although we elect to use ether anesthesia, particularly if both sides are to be dissected.

If the nodes behind the angle of the jaw are malignant, the dissection should include the entire anterior triangle down to the clavicle; the sternomastoid muscle and the internal jugular vein should be removed. Such a radical operation should be done on one side only.

In this series, dissection of one or both sides of the neck has been carried out in 10 cases and no dissection was thought necessary in the 13 others. Positive glands were found twice in the 10 cases.

RESULTS OF TREATMENT

The results of this operative procedure must be considered from the cosmetic and functional standpoints and also on the basis of cure from the cancer. No plastic operation, no matter how perfect the appearance, would be worth doing if the cancer were to recur at once. With the type of lesion described in the following case histories it is our feeling that any local recurrence would appear within a year or two. Many of these cases have been followed for 3 years without recurrence. However, no claim for permanent cure is made on such short follow-ups as we have. It appears that the operation is sufficiently radical to effect a cure in a large percentage of cases.

Many of these patients have smaller oral apertures than before operation. It seems as if all would, but frequently the apertures have stretched out to nearly normal. Not one patient has had any real difficulty from the size of the aperture.

The plastic procedure has failed in two instances. In both patients the cancer had been destroyed by x-ray treatment and the operation was done to correct the resulting defect. There was absolutely no healing and both wounds pulled open within a few days. Obviously, it was an error in judgment to attempt closure so soon after the treatment. One of these patients had in-

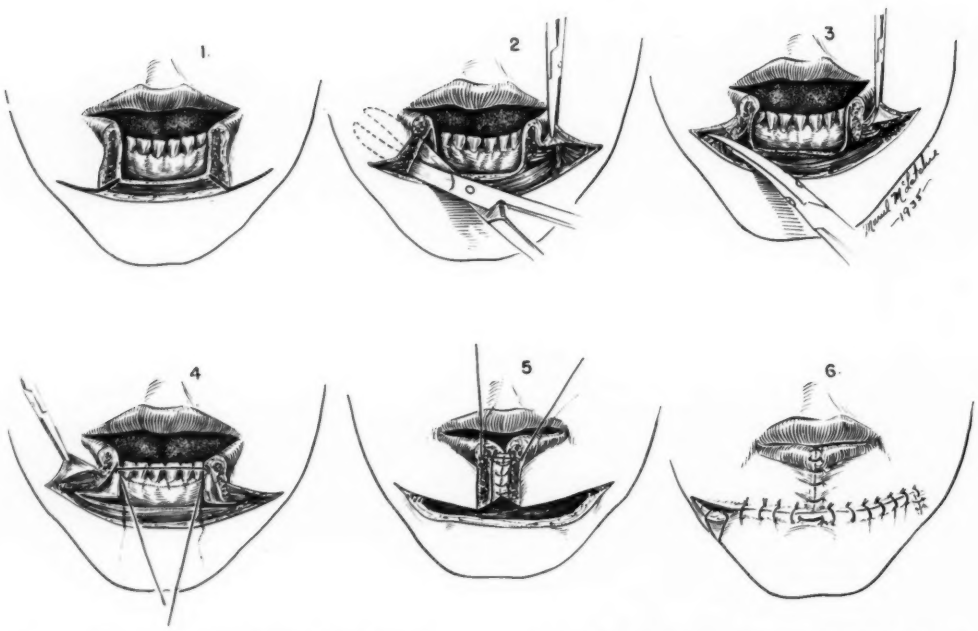


Fig. 3. Technique of operation for closing large defect in lower lip. 1, the carcinoma of the lower lip has been excised leaving a rectangular defect. Lateral incisions are made from the lower border of the defect; 2, the mucous membrane is separated from the skin and muscle; 3, the digitations of the peripheral muscles to the orbicularis oris are divided; 4, closure of the mucous membrane; 5, closure of the muscle and skin; 6, complete closure of the wound. A small triangle of tissue has been removed from the lower incision.

operable glandular metastases at the time of operation and died within a year. The other is a very recent case and the fourth attempt at closure was successful.

Of 14 lower lip cases available for study, one died of neck metastases 1 year after operation. This patient had had a bilateral upper neck dissection with positive glands. Two patients had local recurrences, one in the jaw and one in the lip. Both are free from disease, the first 2½ years after resection of the jaw and the second, 4 months after x-ray treatment of the recurrence. All of the others are free from disease for periods from a few months to 4 years (Table I). Obviously this method of treatment of such large lesions cannot be considered a failure.

Function in the 6 upper lip cases was satisfactory except in the heavily irradiated case which was a failure. The upper lip alone was involved in two instances (Table II). One is well; the other patient had one small recurrence 2⅓ years following treatment, but is now apparently well. The original lesion here was very extensive and temporary palliation was all that was expected and the result is gratifying.

Twice this operation has been done in connection with the removal of extensive cancers involving the upper lip, nose, jaw, and cheek. There has been no recurrence in the lip in either case, although one patient had further trouble in the jaw, but this was successfully treated by irradiation. The other is entirely free from disease 4 years later.

One patient had extensive disease of the nose and face as well as of the lip. He had a rapid recurrence which did not respond to treatment and he is probably dead. The last case was the patient with cancer of the upper lip and commissure with metastases in the neck from which he succumbed. Cure was not expected.

This group is too small to give us definite conclusions. With only the lip involved, the results are satisfactory. When other structures are involved the results are only fair. However, as a part of extensive plastic procedures in rebuilding the face, the method has a place.

Fig. 4. Case 1. a, left. Drawing made at time of operation. Note that about three-fifths of the lip is involved and that about four-fifths has been marked for removal; b, appearance 3 weeks after operation.

Fig. 5. Same case as in Figure 4, front and lateral views. Note shape and size of mouth.

Case 1. L. W., Baker Memorial 11750, admitted to hospital, November 1, 1933. Two years previously he had developed a nodular area in the center of the lower lip. One physician advised against any treatment but later another physician had done a biopsy and found malignancy. During these 2 years there had been a steady increase in size.

On examination, the middle one-half of the lower lip was found to be involved by an ulcerated, indurated new-growth 2 by 2.5 centimeters in size. The growth lay entirely on the mucous membrane and did not involve the vermilion border. One hard node was felt in the right submaxillary triangle.

Operation was done under general anesthesia and consisted of a bilateral upper neck dissection from one sternomastoid muscle to the other and a resection of the central three-fourths of the lower lip with closure by the method described. Following operation the temperature of the patient remained elevated to 101 degrees for 4 days, then became normal. He had a severe cough with much sputum. Eleven days later his temperature rose to 105.5 degrees and a lung abscess was suspected. However, the fever subsided rapidly and there were no further lung complications. The final diagnosis was probable pulmonary infarction. He was discharged 20 days after operation. He was able to eat well and could also whistle, suggesting an intact musculature of his lip. Microscopically, this lip lesion was an epidermoid carcinoma, with no glandular involvement.

When he was last seen in December, 1937, more than 4 years after operation, the cosmetic appearance was excellent and the scars were scarcely visible. There has been no recurrence (Figs. 4 and 5).

Case 2. D. R., Massachusetts General Hospital 305664, aged 62 years, was admitted to hospital in March, 1930. A lesion 1.5 by 1.5 centimeters on the left side of the lip was excised and the left submaxillary region was dissected. The lip lesion was a grade 2 epidermoid carcinoma and the glands were negative. One year later a second carcinoma, grade 1, was excised from the right side of the lip.

On December 26, 1935, the man appeared with a recurrence on the left side, adjacent to the old scar and extending to the commissure. An excision of about three-fourths of the remaining lip was done with the usual type of plastic closure. Right side of neck dissected 1 week later. Pathological reports showed lip, grade 3 epidermoid carcinoma, neck glands negative. Recovery satisfactory except for slight separation of wound with a resulting notch.

He was well until February, 1938, when he showed a recurrence 2 by 1 centimeter. This was apparently due to impingement of one solitary upper tooth on his tight lower lip. After the tooth was removed the recurrence disappeared under x-ray therapy (Fig. 6).

Case 3. P. McG., Massachusetts General Hospital 350012, aged 63 years, was admitted to hospital on December 4, 1935. Examination revealed a carcinoma of the center and left side of the lower lip 2 by 1 centimeter of 6 months' duration with no palpable nodes. Excision of the lesion was done with the usual closure by plastic, taking the flap from one side only. One week later a left upper neck dissection was done. The pathological report was grade 2 carcinoma of lip, glands negative. On January 31, 1938, he was free from recurrence (Fig. 8).

Case 4. M. V., Massachusetts General Hospital 330243, aged 63 years, was admitted to hospital June 30, 1933. He

Fig. 6. Case 2. a, left. Carcinoma of the upper lip before operation; b, result 4 months later. Patient has been free from disease for over 4 years.

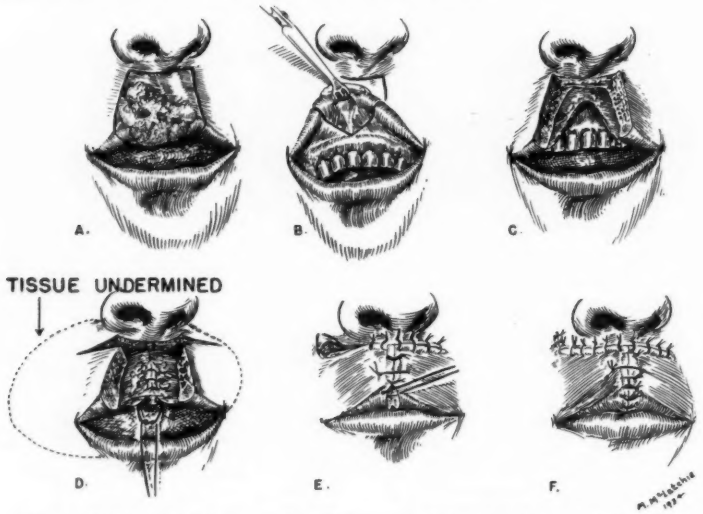


Fig. 7. Carcinoma of the upper lip. The same technique has been carried out as in the operation for carcinoma of the lower lip.

had a lesion on his lower lip which had been present 1¼ years and for which he had received three radium treatments without benefit. The middle half of the lower lip was involved in an outcropping new-growth 4 by 1.5 centimeters. In the left submaxillary region a firm node 1 by 1 centimeter was palpable.

On July 1, 1933, the middle two-thirds of the lip was excised and the defect was closed by rotating the orbicularis muscle with the skin. Ten days later a bilateral upper neck dissection was done. The pathological examination was grade 2 epidermoid carcinoma of the lip with no carcinoma in the neck. The lip wound separated entirely after the second operation, presumably due to ligation of part of the blood supply, and a secondary suture was done.

He was not seen again until September 2, 1936 (3 yrs. 2 months after operation), when he returned with a tiny fistula in the old scar, which had been present since the first operation. There was no recurrence in the lip or neck. The fistula was successfully closed (Fig. 9).

CASE 5. W. R., Pondville Hospital 11641, aged 46 years, was admitted to hospital November 7, 1936. The outer third of the lower lip was involved in a hard, nodular growth, while the middle third showed more superficial indurated areas. A hard node 1 by 1 by 1 centimeter of 4 months' duration was felt in the left submaxillary region.

On November 9, a left upper neck dissection was done, and the involved portion of the lip was removed. The defect was closed in the usual manner. Pathologically, the growth was a grade 2 epidermoid carcinoma and the glands showed only hyperplasia. No dissection is contemplated for the other side.

In February, 1938, there was no recurrence in the lip or neck. The cosmetic result was satisfactory, although the lower lip was still somewhat tight.

CASE 6. P. C., Pondville Hospital 11914, aged 64 years, was admitted to hospital January 7, 1937. Examination showed a papillary carcinoma 1.2 centimeters in diameter in the left central portion of the lip with small movable nodes

Fig. 8. Case 3. a, left. Carcinoma of lower lip involving nearly one-half the lip; b, result after operation. In one the plastic operation has been done on one side only. Note the new commissure. Patient free from disease over 2 years.

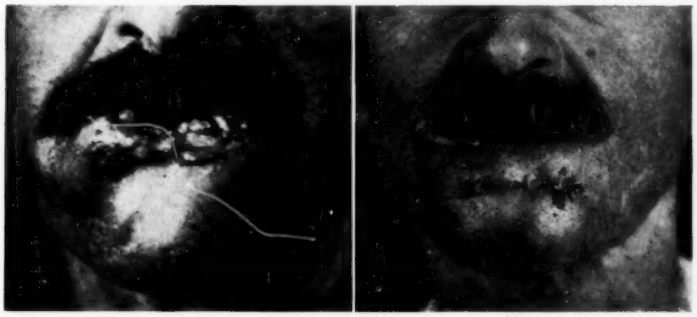


Fig. 9. Case 4. a, left. Carcinoma of lower lip before operation; b, result 3 years later. A persistent sinus has just been closed. The lymph nodes in both sides of the neck were negative.

in each submaxillary region. A rectangular area was excised and a plastic was done on January 18. Eleven days later a left upper neck dissection was done. Pathological examination showed a grade 1 epidermoid carcinoma of the lip with hyperplasia of the lymph nodes.

This is one of the more recent cases in the series. The immediate postoperative result is satisfactory. There was no recurrence up to October, 1937.

CASE 7. J. D., Pondville Hospital 8805, aged 78 years, was admitted to hospital December 9, 1934. He had an extensive carcinoma of the lower lip of 2 years' duration. Previous treatment had consisted of desiccation and radium seeds at another institution. A large radiation ulcer with active growth was present, but no lymph nodes were palpable.

A section of the lower lip, measuring 3 by 2 centimeters, was excised and the defect was closed by the usual technique. Pathological examination revealed epidermoid carcinoma, grade 1, with radiation reaction. No neck dissection was done.

He died on January 25, 1936, of pneumonia. There had been no recurrence of the lip lesion.

CASE 8. J. C., Pondville Hospital 7650, aged 65 years, was admitted to hospital April 7, 1934. Examination showed a carcinoma of the central two-thirds of the lower lip of 3 months' duration. The patient had had no previous treatment. The Wassermann test was positive. His teeth were very bad. There were no palpable lymph nodes in the neck. His general condition was poor in that he was just recovering from an operation for a perforated duodenal ulcer.

Several days were consumed in extracting teeth and cleaning up his mouth. Operation was done under novocain. A segment of lip measuring 5 by 2.5 centimeters was removed. Healing occurred promptly in spite of a very tight wound closure. The pathological report was epidermoid carcinoma, grade 1. No neck dissection was done, but it was our intention to do it if nodes appeared.

In June, 1937, his local clinic reported that there was no recurrence.

CASE 9. V. D., Pondville Hospital 5969, aged 56 years, was admitted to hospital March 28, 1933. A V excision was done for a small lesion on the lower lip, reported as epidermoid carcinoma, grade 2. The patient refused neck dissection. Deep x-ray therapy (2400 r units) was given to the left neck.

Three years later he returned with a new lesion immediately adjacent to the old scar, size 2.5 by 2.5 centimeters. A firm node was palpable in the left submaxillary region.

A bilateral neck dissection and a wide excision of the lip lesion with plastic closure were done at one sitting. There was some separation of the lip wound during the next few days with sepsis in the right side of the lip. The pathological report showed a grade 1 lesion on the lip with no involvement of the neck nodes.

Fig. 10. Case 9. a, left. Carcinoma of lower lip before operation; b, result 3 months later. Patient well 4½ years.

Fig. 11. Case 14. a, left. Carcinoma of lower lip before operation; b, result 2 weeks after operation. Patient well 4½ years.

He was examined in his local clinic in January, 1937, and found to be free of disease. A social worker made the same report October 22, 1937.

Note—It was a mistake to do the lip and the neck operations at the same sitting (Fig. 10).

Case 10. W. C., Pondville Hospital 8237, aged 73 years, came to the outpatient department August 2, 1934, for advice about an olive-sized lesion on the lower lip. Wide excision was advised and the man was sent back to his own hospital where the lesion had previously been treated by x-ray. At that hospital the lesion was treated by electrocoagulation. He returned to us 3 months later with a large defect in his lip with apparently active new-growth but no palpable lymph nodes. He was drooling constantly.

Wide excision with plastic closure was done on November 5, 1934. Three months later a skin graft was placed inside the lower lip to provide a sulcus between the lip and jaw. Tissue removed at these two operations showed no cancer.

Three months later he appeared with a recurrence at the base of his lip and also involvement of the jaw. Resection of the lower jaw was done by Dr. G. W. Taylor. Later, several plastic operations were done by Dr. Taylor to restore his lip and buccal mucosa. Both sides of the neck were dissected at separate sittings and grade 1 carcinoma was found in the nodes.

In June, 1938, there was no evidence of recurrence. Patient had no complaints except for some drooling of saliva. He had been able to maintain his weight fairly well.

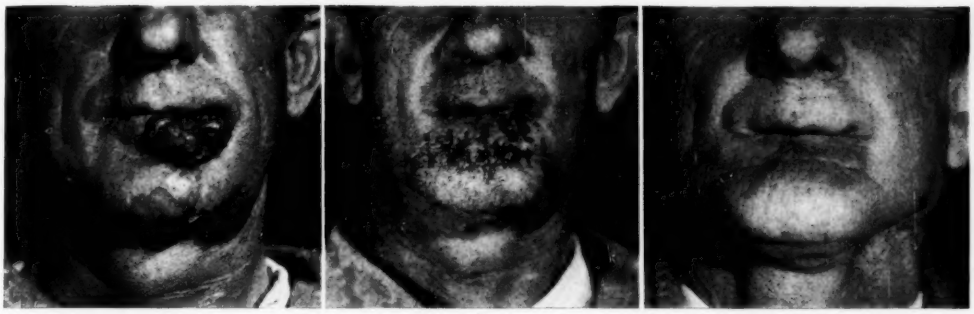
Case 11. J. K., Pondville Hospital 9781, aged 74 years, was admitted to hospital August 27, 1935. Examination showed a carcinoma, measuring 2.5 by 2.5 centimeters on the right side of the lip with a smaller lesion, 0.5 by 0.5 centimeter at the left of the midline. There were no palpable nodes in the submaxillary areas, but there was a small one in the submental triangle. He had previously received several x-ray treatments without benefit.

He also had a hard tumor mass in the right inguinal region, extending into the right lower abdominal quadrant. There was a marked induration of the epididymis with thickening along the vas deferens. There was a scar along the iliac crest from an operation 15 years before, the details of which were not known. This mass was apparently not primary in the genito-urinary or gastro-intestinal tracts and its exact nature was unknown.

Operation was done on September 2, 1935, under local anesthesia. About two-thirds of the lip was removed. The lip healed without difficulty. The pathological report was epidermoid carcinoma, grade 2. One month later the wound was well healed. He died at home 2 months after operation, apparently from his abdominal condition.

Case 12. J. V., Pondville Hospital 8724, aged 67 years, was admitted to hospital November 22, 1934. He had an ulcerated carcinoma involving the left half of the lower lip, without palpable lymph nodes. He had previously had radium treatments and a submental dissection with temporary improvement in the lip lesion.

Several bad teeth were removed, the lesion was excised and a plastic was done. The specimen measured 3.5 by 2.5 by 2 centimeters and pathological examination showed epidermoid carcinoma, grade 1. No neck dissection was done.



a b c

Fig. 12. Case 15. a, Carcinoma of lower lip before operation; b, result 1 week after operation; c, result 2 months after operation. This patient had bilateral dissection of the upper neck glands in both sides of the neck which were positive. He died of a recurrence in the neck 1 year following operation.

On February 4, 1937, he was examined and was free from disease. There were no palpable nodes.

A Public Welfare report said he was all right in December, 1937.

CASE 13. J. D., Pondville Hospital 8185, aged 69 years, was admitted to hospital July 28, 1934. Examination showed carcinoma of 8 months' duration, involving the central half of the lower lip with ulceration and induration. One small node was palpable in the right submaxillary triangle.

The middle two-thirds of the lower lip was removed under novocain, the specimen measuring 3.5 by 2.5 centimeters. Pathological examination revealed epidermoid carcinoma, grade 2. The wound healed well and 2 weeks later a right upper neck dissection was done. The nodes showed no cancer. Dissection of the other side was advised but refused by the patient.

He died June 4, 1935, of coronary heart disease, without recurrence of the cancer.

CASE 14. J. G., Pondville Hospital 7698, aged 77 years, was admitted to hospital April 5, 1934. The lower lip was involved by an ulcerated, destructive new-growth. There were no hard nodes in the neck.

The middle two-thirds of the lip was excised under novocain and the defect closed. There was some sepsis in the wound and a fistula developed. This healed rapidly, however. Pathological examination of a section of lip 4 by 2.5 centimeters showed epidermoid carcinoma, grade 2.

No dissection of the glands was done. He was free of disease in September, 1937. The cosmetic result was very good. He was edentulous but wished to have teeth fitted if possible (Fig. 11).

CASE 15. A. S., Pondville Hospital 9503, aged 54 years, was admitted to hospital June 15, 1935. The left half of the lower lip showed a proliferating, ulcerated carcinoma from the commissure to the midline. This had been present for 18 months and he had noticed a lump in the neck for 4 months. He had hard movable nodes in the submental space and a hard, slightly fixed node in the left submaxillary area. His teeth were very bad and these were all extracted before his lip was operated on. The Wassermann reaction was positive.

A segment of lip 5 by 3 centimeters was removed under novocain, and the wound was closed by a plastic operation. The pathological report was epidermoid carcinoma, grade 2.

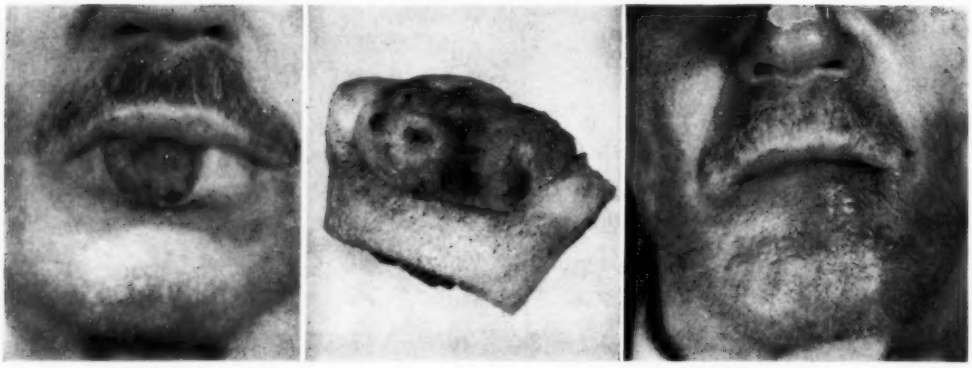
One week later a right upper neck dissection was done under ether. He behaved badly under ether and the second side was not dissected, but later this was done under novocain. Microscopically the nodes in both sides of the neck showed grade 2 epidermoid carcinoma. His lip and neck wounds healed well. His mouth aperture was very small.

Eleven months later he returned with a massive recurrence along the left sternomastoid muscle down to the clavicle. He received x-ray therapy (1200 r) to the left lateral neck on June 16, 1936. The growth was very rapid, and he died on July 8, 1936, of bronchopneumonia. Pathological examination at autopsy showed the same grade as previously and no metastases except in the neck. There was no recurrence in the lip.

Note—The operative note on the second neck dissection stated that a metastatic node was found along the internal jugular vein. This should have been the deciding factor in doing a radical dissection on this side. Had this been done, the outcome might have been different (Fig. 12).

CASE 16. H. H., Westfield Sanatorium, Cancer Section 45, aged 64 years, entered sanatorium on January 6, 1938. Examination revealed a fungating mass just to the left of the midline on the lower lip involving the mucous membrane and a small portion of the skin. The mass was hard in consistency and measured about 2.5 centimeters in diameter. His teeth were carious. There was no evidence of glandular involvement. On January 10, 1938, the patient had complete extraction of twenty-one teeth. Nine days later, at which time there was satisfactory healing of the gums, excision of the carcinoma with plastic to the lower lip was done under local anesthesia. Convalescence was satisfactory, except for two minor stitch infections which subsequently healed satisfactorily, and the patient was discharged on the fourteenth postoperative day. The pathological report was epidermoid carcinoma of the lower lip, grade 2. When the patient was seen in the outpatient department on July 20, 1938, the wound was well healed and the angles of the mouth were symmetrical. There were no palpable glands. The patient was working and in good general health (Fig. 13).

CASE 17. W. R., Massachusetts General Hospital 94888, aged 65 years, was admitted to the Tumor Clinic in November, 1937. He showed an indurated, excavated lesion 2 by 1½ centimeters in size on the right side of the lower lip. There was an enlarged, firm node under the angle of the jaw. A biopsy was done but the specimen was unsatisfactory for diagnosis. High voltage irradiation was given in three cycles from November to March. One month after the last treatment it was felt that there was



a b c

Fig. 13. Case 16. a, Carcinoma of lower lip before operation; b, photograph of specimen showing the amount of normal tissue removed with the tumor; c, result 2 months after operation.

persistent disease present. He had a deep ulcer from which saliva constantly oozed. He was referred to the hospital for excision.

Excision was done on April 5, 1938, by a senior visiting surgeon and the patient was allowed to go home the following day. The stitches were removed 1 week later, but the lower portion of the incision separated. The pathological report on the tissue removed was "acute and chronic inflammation." He was readmitted 3 weeks later and the defect, now completely separated, was closed. Again there was separation.

One month later a third attempt was made by the writer. The edges were excised, and the type of plastic described was used. On the sixth day separation occurred. At the fourth operation the method used was a combination of the one used previously and the one referred to earlier in this article[1] and it was successful. The node in the neck has disappeared.

Note.—Any attempt at surgery in a lip as heavily irradiated as this one was ill advised and failure was inevitable.

Case 18. W. M., Massachusetts General Hospital 336128, aged 42 years, was admitted to hospital in March, 1934. He presented an indurated, ulcerated, nodular tumor of the upper lip, measuring 1.5 by 2 centimeters of but 6 weeks' duration. A dark field examination was negative for spirochetes. Biopsy showed "a benign epithelioma." There were no palpable lymph nodes.

On March 28, 1934, the lesion was excised. Closure was by the same method described for the lower lip. This was the first time the operation had been used on the upper lip. Healing was uneventful. Pathological examination showed epidermoid carcinoma, grade 1.

He was last seen on June 29, 1938. His scars were scarcely visible and his mouth showed no appreciable narrowing. There were no palpable lymph nodes and there was no recurrence in the lower lip.

Note—No neck dissection was advised in this case. Inasmuch as this was a grade 1 carcinoma, it was thought neck dissection was unnecessary unless nodes appeared.

Case 19. J. K., Pondville Hospital 3643, aged 76 years, was admitted to hospital August 21, 1931. Three years previously he had received radium treatment to a carcinoma of the buccal mucosa at a hospital in a nearby state. On admission to Pondville there was a large area of necrotic carcinoma inside the right cheek, involving the commissure with a large perforation in the cheek. There was also a hard, fixed mass in the submaxillary region. Biopsy showed adenocarcinoma. Radium needles were used to destroy the lesions of the mouth and face and deep x-ray was used on the neck. The former cleared up entirely and the latter area showed marked improvement.

He returned in June, 1934, with no recurrence in the face or mouth but the glandular metastasis was active and more irradiation was given. His chief difficulty was from the defect caused by the destruction of his mouth cancer. Nearly half of the upper lip, together with an area at the commissure, was missing.

In September, 1934, the dense scar tissue was excised, the remainder of the upper lip was mobilized, and the defect was closed by uniting the edges of the orbicularis muscle and skin. The result at first was very satisfactory, but a few days later the wound was separated, and the defect was as bad as before.

In January, 1937, he was again a patient in the hospital with active disease in the neck, now giving him considerable pain. He was 81 and no further surgery was done. He died of cancer in the neck in June, 1937.

Note—This is one of 2 cases in the series in which total separation of the wound has taken place. Doubtless the irradiation was largely responsible for the failure.

Case 20. J. W., Massachusetts General Hospital 350737, aged 63 years, was admitted to hospital December 30, 1935. Thirty years ago he received x-ray treatments to his nose and face for lupus vulgaris. For 1 year he had had an ulceration of his upper lip. Examination showed an ulcerated, indurated lesion 2 by 3 centimeters on the upper lip, extending onto the right cheek. There were no palpable lymph nodes.

Excision of the lesion was done on January 2, 1936, leaving a full thickness defect on the lip and a large defect on the cheek. The lip defect was closed by rotating the commissures and the muscles. The remainder of the defect was closed by a sliding flap from the cheek. The immediate result was satisfactory. The pathologist reported a grade 2 epidermoid carcinoma.

On June 25, 1936, he appeared with a 2 by 2 centimeter recurrence in the center of the upper lip. He received high voltage x-ray treatment (2100 r units) but he did not complete the treatment planned.

[1]New England J. Med., 1931, 205: No. 24.

On August 10, 1936, he was admitted to the Pondville Hospital (11275), still with active disease. He was given deep x-ray (1800 r units) and discharged on August 25, 1936. He has not been seen since, but a letter from his local clinic stated that his disease was very extensive and he has probably died.

CASE 21. M. C., Massachusetts General Hospital (Phillips House) 32558, aged 42 years, was first seen on November 7, 1933. His lesion began on his eyelid 14 years ago and slowly advanced without treatment for 9 years. He was then seen by a surgeon who advised exenteration of the orbit, but this was refused. Inasmuch as he was a Christian Scientist he never felt the need of medical care until admission.

Examination showed a large ulceration on the right side of the face with active indurated edges. The disease involved the right side of the nose, about half of the upper lip, the outer third of the lower lip, the antrum, orbit, right frontal sinus, zygoma, malar bone and the tissues over the ascending ramus of the jaw. There were no palpable lymph nodes.

On November 14, 1933, a very extensive electrosurgical excision and electrocoagulation was done, following ligation of the external carotid artery. It was possible to encircle all the disease except one area on the posterior wall of the frontal sinus where there was erosion through to the dura. Following operation he received deep x-ray treatment to the entire wound but particularly to the posterior wall of the frontal sinus. In March, 1934, plastic operations were started. The following year reconstruction of the right side of the nose, the upper lip, lower lip, and entire cheek was done, until the only defect left was the orbit and the frontal sinus.

The operation described in this paper was used to reconstruct the upper lip and it was possible to rotate the lip so that hair-bearing skin was used for the entire upper lip. This made it possible for the man to grow a mustache and to help cover the scars.

There has been no recurrence of his carcinoma in 4½ years. The reconstructed mouth has been very satisfactory.

CASE 22. S. M., Huntington Hospital 341089, aged 63 years, was admitted to hospital on September 26, 1934. Examination showed an extensive lesion of the left side of the nose at the ala, involving the upper lip and extending through the hard palate into the mouth. It had also destroyed part of the nasal septum. The lesion had been present and increasing in size for 15 years. Biopsy showed basal cell carcinoma.

On September 26, 1934, electrosurgical excision was done under avertin anesthesia. One inch of the upper lip, the septum, the turbinates on the left, the left ala, and a portion of the upper jaw were removed. Flaps were mobilized and the upper lip was reconstructed across the defect in the bone.

Later, reconstruction of the nose was done from forehead flaps. An upper denture was made to fill the defect in the upper jaw and to bring the upper lip gradually forward.

In March, 1937, a recurrence appeared in the nose and on the upper jaw behind the defect. Electrocoagulation was done twice and high voltage x-ray treatment was given. New carcinomas of the hand have been effectively treated. There has been no recurrence in the upper lip on which the plastic was done. It is doubtful if there will be a permanent cure in this case, but the plastic procedure has had a part in giving him palliation. The patient was last seen on September 20, 1938.

CASE 23. C. C., Massachusetts General Hospital 5255, aged 70 years, was admitted to hospital first on September 8, 1933. She gave a history of having had lupus vulgaris of the nose and lip 50 years before. A basal cell carcinoma of the upper lip was removed by another surgeon. In June, 1934, a recurrence was removed by the writer. In November, 1935, she returned with extensive involvement of the entire upper lip and of the tip of the nose which had already been badly damaged by the lupus.

A radical removal of the entire upper lip was done with reconstruction by the usual technique. The nasal lesion was also excised. Pathologically, this was a basal cell carcinoma with foci of keratinization and with a few tubercules. Recovery was uneventful, the function of the lip is satisfactory, but the cosmetic appearance is far from good.

She remained well for nearly 2 years when a small ulcer appeared in the center of the scar. This did not respond to irradiation and was excised. It proved to be a grade 3 epidermoid carcinoma. The defect was closed by an immediate thick skin graft. She is now 75 and works regularly as a housekeeper. Five years ago it was considered doubtful if her heart would stand up under any operation.

SUMMARY

An operation is described for the reconstruction of either the upper or lower lips when any amount less than the total width of the lip has been removed. The advantage of this operation is that it leaves a completely intact musculature of the mouth. The only disadvantage is that the mouth is smaller than normal.

The cosmetic results in the patients operated on by this method have been satisfactory. The functional results have been good.

As a curative operation it appears to be adequate, although few of the patients have been followed more than 3 years.

Case histories of 23 patients upon whom the operation has been used are presented.

NON-TRAUMATIC PARALYSIS OF THE DORSAL INTEROSSEOUS NERVE

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THERE has accumulated in the literature a small number of cases of isolated paralyses of the dorsal interosseous nerve. Though this group is small it is an exceedingly interesting one, not only on account of the curious clinical picture, but also because there has been no satisfactory explanation of the causative factors.

The syndrome consists of the progressive paralysis and subsequent atrophy of the muscles innervated by the dorsal interosseous nerve. The onset may be gradual or fairly rapid and is manifested first, in the typical case, by the inability to extend the little finger. In time the fourth finger is affected in the same way, and then relentlessly the third, second, and index finger, and finally the thumb. In the full blown case the afflicted person is unable to extend any of the fingers or extend and abduct the thumb. Wasting of the bellies of the extensor muscles of the fingers eventually follows, so that the dorsum of the forearm becomes atrophied. Reaction of degeneration to electrical stimulation occurs in these muscles. The extension of the wrist, though impaired, is relatively preserved, owing to the fact that part of the extensor function of the wrist is carried out by muscles not innervated by the dorsal interosseous nerve. The paralysis has not been accompanied by any disturbances of the sensory innervation of the hand or arm. There have been no spontaneous recoveries, or for that matter, any produced by therapeutic measures.

Several speculations have been advanced to explain the syndrome. Woltman and Learmonth who published reports of cases, proposed on the basis of their one case in which operation was carried out, that the paralysis is caused by an anomaly in the course of the nerve. They admitted, however, that this hardly seemed a satisfactory explanation.

Guillain, Georges, and Courtellement suggested that the cause might lie in chronic trauma to the nerve produced by too frequent pronation and supination of the arm since the nerve passes through the substance of the supinator brevis muscle. Grigoresco and Iordanesco were of the opinion that direct trauma to the nerve possibly accounted for the paralysis in their case. On analysis, however, none of these explanations serves to explain all of the clinical facts noted in these cases. The opportunity to study 2 cases recently prompted a review of the 10 cases recorded in the literature and on the basis of this analysis to advance a tentative theory, which, though it requires future verification, seems adequately to account for the entire clinical picture.

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CASE 1. The patient was a 41 year old dairy farmer who was admitted to the neurosurgical service of Dr. Francis C. Grant complaining of inability to open his hand and of wasting of his forearm. His work consisted chiefly of milking 20 cows twice daily, a task that he had performed for 25 years. About 5 months before admission while cranking a tractor the crank "bucked" and threw him backward wrenching his arm. Immediately afterward his forearm and wrist felt sore and he consulted a physician. He could find nothing wrong, but took an x-ray picture which, however, was reported negative. He continued working and the soreness wore off. He noticed shortly after this incident that when he shook hands with friends he had difficulty in relinquishing his grasp. When he observed his trouble closely he found that it was due principally to inability to extend his fifth and fourth fingers. In the following 3 months, the third, second, and index fingers became weak and this interfered with his work. Toward the end of milking a cow the final "stripping" of the udder requires twisting of the hand necessitating a degree of ulnar deviation; this he found he was unable to do well. He gradually became aware that the back of his forearm appeared thinner. A month before admission the "back kick" of an automobile crank again "threw him" and he experienced a tingling throughout the forearm for several hours. Subsequent to this second accident he found that after milking a while there was rapid fatigue of his arm and an unpleasant drawing sensation extending from his wrist to his elbow.

The general physical examination was essentially negative. He possessed an unusually powerful muscular development. The neurological findings were limited to the right arm and hand. There was inability to extend any of the fingers and to extend and abduct the thumb; the weakness was greatest in the fifth and fourth fingers (Fig. 1). The opposing function of the thumb was intact, flexor power of the fingers was normal and his grip was equal to that of the left. He was able to extend the wrist, though weakly. The forearm was wasted over the dorsolateral aspect and this was emphasized by the compensatory hypertrophy of the brachioradialis and extensor carpi radialis longus muscles. Both these muscles derive their innervation from the radial nerve just above the origin of the dorsal interosseous nerve (Fig. 2). Radial deviation was possible though ulnar deviation was not. Just below the elbow in the region of the insertion of the radial head of the biceps tendon there was a point so tender to deep pressure that pressing upon it caused the patient to wince. The tender-

Fig. 1. There is paralysis of extension of the fingers and thumb of the right hand. The wrist is partly though incompletely dorsiflexed. The fingers already show a mild degree of flexor contractures. Case 1.

Fig. 2. The two forearms are compared to demonstrate the marked atrophy of the bellies of the extensors of the fingers of the right arm. The contrasting hypertrophy of the brachioradialis and extensor radialis longus muscles is clearly depicted. These latter receive their innervation from the radial above the origin of the dorsal interosseous nerve. Case 1.

ness was sharply localized and there was no radiation of the pain. Electrical stimulation showed that the common extensor, the extensor carpi ulnaris and the extensors pollicis longus and brevis were inactive to stimulation carried up as high as 250 volts. Stimulation of the radial nerve directly with galvanic current failed to provoke movement in any of the muscles supplied by the dorsal interosseous nerve. The brachioradialis and the extensor carpi radialis longus reacted promptly.

Operation to explore the nerve was offered to the patient, but he refused because no definite assurance of improvement could be given him.

Case 2. The patient was a 32 year old woman admitted to the neurosurgical service of Dr. Francis C. Grant in May, 1938, complaining of inability to open the fingers of her left hand. The patient had been a corsetière for 5 years before the onset of her trouble. About 4 years before admission she began to notice that she could not open the last three fingers of her left hand. This was brought to her attention mainly through a feeling of weakness in these fingers, noted when she attempted to "pull down" a corset. In performing corset fittings she pulled the lower edge of the corset forcibly down over the hips of the customer with her left hand and held it so while pinning with the right hand. She fitted from 12 to 15 corsets daily and stated that at the end of her working day her left arm and hand were always very tired. Occasionally during the day it "cramped" from the strain and she had to massage it.

In the 6 months following the onset of weakness of her last three fingers, the weakness spread and involved her index finger and thumb so that she was unable to open any of her fingers. Since then there has been no change, except that lately her fingers "curl in" toward the palm and are difficult to straighten out. In the past 3 years she has also been aware of a gradual wasting of her forearm. Massage and heat treatments have not helped her.

The general and neurological examinations were normal except for the condition of her left arm. There was a paralysis of extension of all the fingers of the left hand and a paralysis of abduction and extension of the thumb (Fig. 3). The ulnar and median functions were all present and intact. The wrist could be weakly extended and the hand could be freely ulnar deviated but could not be radially deviated. There was a mild degree of contracture in the unopposed flexor tendons of the fingers. The bellies of the extensor muscles of the fingers were atrophied causing marked wasting of the forearm. The brachioradialis and extensor carpi radialis longus were again preserved, but in this patient not hypertrophied. The muscles innervated by the dorsal interosseous nerve were entirely unresponsive to electrogalvanic stimulation even when carried up to 250 volts. The brachioradialis and extensor carpi radialis longus reacted promptly to normal threshold stimulation. Sensation was examined minutely with graduated von Frey hairs and thorns, but no sensory disturbances were found.

Approximately 2 inches below the bend of the elbow over the insertion of the radial head of the biceps tendon was a point exquisitely painful to deep pressure. The patient cried out when it was pressed upon. She had not been aware before that there was a tender spot. On deep pressure it was possible to feel a small nodule sliding under the fingers and this seemed to be the most tender site (Fig. 4).

It was suggested to the patient that exploration of the nerve offered the only possibility of relief, but since no assurance of cure could be offered, the patient refused operation and left the hospital.

ANATOMICAL FEATURES

It appears that the solution of this syndrome may depend upon certain pathological processes and more especially upon certain anatomical features which heretofore have not received recognition in the published reports.

Briefly, the radial nerve terminates a few centimeters above the lateral condyle of the humerus by dividing into the dorsal interosseous nerve and the superficial radial cutaneous nerve. The dorsal interosseous nerve descends in the cleft between the brachialis and brachioradialis muscles, passes under the extensors carpi radialis longus and brevis, turns obliquely and pierces the supinator brevis muscle. It emerges at the lower border of the supinator and breaks up into two main branches, one of which supplies the common extensor, extensor carpi ulnaris, and the extensor digiti quinti proprius. The other innervates the abductors pollicis longus and brevis and the extensor indicis proprius. The superficial radial which is entirely sensory pursues a more superficial course in the arm and continues down the

Fig. 3. In this patient there is paralysis of extension of the fingers and thumb of the left hand with an advanced degree of flexor contractures. The wrist can still be weakly extended. The wasting of the forearm is quite noticeable. Case 2.

Fig. 4. The dot on the left upper forearm indicates the point beneath which there is extreme tenderness. This corresponds to the location of the bicipitoradial and interosseous bursæ of the elbow. There is an exactly similar point in the first case. Case 2.

radial border to supply the sensory area of the radial nerve on the back of the thumb and the anatomical snuff box.

The anatomical fact, which we believe to be highly important in the explanation of the paralysis of the dorsal interosseous nerve, is the relationship of the nerve to two bursæ of the upper forearm. Just before the nerve penetrates the supinator brevis it skirts lateral and posterior to the bicipitoradial and interosseous bursæ of the elbow. It is closely applied to the posterior walls of these bursæ. No mention of this relationship is made in the standard texts on anatomy. As a matter of fact, only the most meager descriptions of the bicipitoradial bursa could be found on consulting Cunningham's, Gray's, Piersol's, and Morris' anatomies, and there was no mention made whatever in these works of the interosseous bursa of the elbow. However, in Toldt's *Atlas of Anatomy*, section on myology, these two bursæ are well depicted and described as follows: "The interosseous bursa of the elbow is in contact with the interosseous membrane and the oblique ligament posteriorly, projecting forward, it separates the tendon of the brachialis anticus on the inner side from the tendon of the biceps and the upper part of the insertion of the supinator brevis on the outer side. The bicipitoradial bursa lies medial to it separated partly by the tendinous insertion of the biceps tendon." These two bursæ apparently facilitate the movements of the biceps tendon. Figure 5 indicates the close application of the dorsal interosseous nerve to these bursæ.

DEDUCTIONS FROM ANALYSIS OF CASES

Evidence can be adduced from the analysis of the reported cases to indicate that the syndrome of progressive paralysis of the dorsal interosseous nerve is a consequence of changes produced in the nerve by pathological alterations in the walls of these bursæ and in the tissues immediately adjacent to them. In respect to this hypothesis several pertinent questions arise. First, whether there is evidence already existing that a bursitis can cause alterations in a nerve sufficient to produce neuritic signs. Second, whether there are in these cases of paralysis of the dorsal interosseous nerve evidences pointing to the probable presence of a bursitis. Third, whether the recorded instances of paralysis of this nerve contain in their histories circumstances predisposing to a bursitis affecting these bursæ, and last whether

the literature contains references to injury of the dorsal interosseous nerve by disease of these bursæ.

Though the significance of the bursæ of the body is generally overlooked in the neurological literature, several bursæ diseases are known to cause neuritic manifestations in nearby nerves.

O'Conner and again Elgart reported cases of traumatic inflammation of the iliopectineal bursa which, owing to its contiguity to the femoral nerve, caused severe pains in the distribution of the nerve and atrophy of the quadriceps group. Weakness of the leg, atrophy of the thigh, radiating pains, local tenderness and dragging of the toes, followed a bursitis provoked either by a traumatic incident as a sudden twist or else following repetitive trauma occuring in the course of the patient's occupation. Again inflammatory changes in the ischiogluteal bursa, the so called "weaver's bottom," caused by constant trauma may produce neuritic symptoms in sciatic nerve. The fact that bursitis may cause neuritic signs is apparently well established at least in the orthopedic literature.

In reviewing the case reports of paralysis of the dorsal interosseous nerve, one is struck by the frequent references to the presence of either pain at some time in the course, or else by the presence of tenderness of the affected arm on examination. Apparently no significance has been attached to this phenomenon and no attempt made to relate it to the paralysis. Woltman and Learmonth gave merely a passing reference to the fact that several patients had pain in the arm.

In the case of Guillain and co-workers the patient was an orchestra leader who suddenly noted weakness in his right small finger. This was followed in 10 days by involvement of the fourth and third fingers. In addition to the extensor weakness the author noted a point of great tenderness over the dorsal interosseous nerve where it entered the substance of the supinator brevis.

In the third case of Woltman and Learmonth the patient 2½ months after an appendectomy accompanied by fever noted weakness of the small finger, which was followed in a week by paralysis of extension of the other fingers. There was a tender point over the dorsal interosseous nerve 7 centimeters below the elbow joint.

In their fifth case the patient developed over the course of 6 months paralysis of extension of all the fingers and the thumb, and wasting of the forearm. She complained of sharp twinges of pain in her upper forearm. She habitually slept with her head pillowed on her right forearm.

In the case described by Hobhouse and Heald, rapid onset of weakness of extension of the fingers

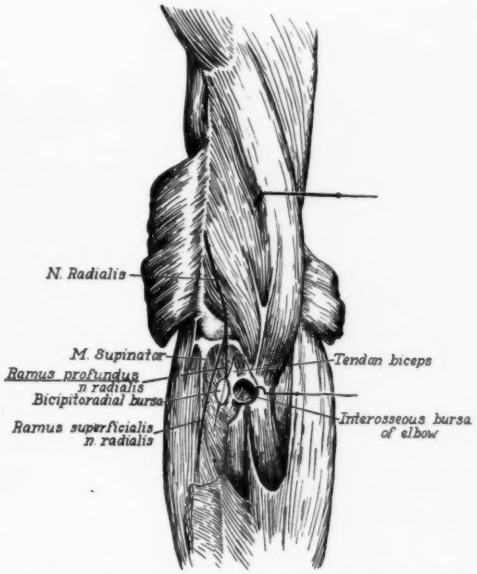

Fig. 5. The semi-diagrammatic drawing is adapted from Toldt's *Atlas of Anatomy*. The course of the ramus profundus n. radialis (dorsal interosseous) has been drawn in to show its relation to the bursa. The "interosseous bursa of the elbow" has been drawn mesially and actually overlaps a short portion of the nerve. The nerve passes behind the "bicipitoradial bursa."

was ushered in by a severe dull pain in the region of the elbow. The patient held the arm in flexion to avoid pain. The pain gradually eased, but on subsequent observations, the paralysis of the muscles supplied by the dorsal interosseous nerve became more complete and wasting of the forearm occurred. No sensory signs were noted.

In Jumentie's case, weakness of the fifth, fourth, and second fingers appeared accompanied by a tender swelling across the dorsum of the wrist and up the forearm. These were interpreted by the author as due to a tenosynovitis involving apparently the synovial sheaths of the wrist and of the tendons of the common extensor. While this case is not strictly comparable to the others, it serves to illustrate the point that inflammations of the synovial membranes may affect the adjacent nerves. Structurally the bursa and the synovial sheaths are identical, consisting of a fibrous sheath lined with endothelium.

The 2 cases here reported both showed a point tender to deep pressure approximately over an area beneath which lay the bicipitoradial and interosseous bursæ of the forearm.

Thus in the 12 cases now reported there are direct evidences of pain in the arm, and of tenderness on examination in 6.

Since the dorsal interosseous nerve is purely motor, it is obvious that pain could not be a symptom, nor tenderness a sign of primary involvement. On the other hand, the type of pain and the area of distribution does not conform to an affection of the superficial radial nerve, for in that case the pain should be referred to its area of innervation and the tenderness should be found along its course; neither of which has been the case. Moreover, pathological processes in a sensory nerve acting over long periods of time should be expected to produce abnormalities of sensation in the cutaneous distribution. This has not been seen in any of the cases.

In view of these considerations, it is evident that the source of the pain must be sought for in some local process, one capable of causing pain and at the same time producing neuritic symptoms in the dorsal interosseous nerve. More particularly, this process must be primarily non-neurogenic, since notwithstanding the presence of pain, there are no signs of radial sensory nerve implication. The clinical histories and findings in the quoted cases viewed in connection with the anatomical relationships of the nerve make it highly probable that the dorsal interosseous nerve is injured by inflammatory reactions occurring in the walls of the contiguous bicipitoradial and interosseous bursæ of the elbow. The bursæ, of course, are supplied by nerves mediating deep sensation and it is the irritation of these that provide the source of the pain.

According to Campbell and Hertzler, trauma causes effusions into the bursal sacs with inflammatory changes taking place in the bursal wall and adjacent tissues. The bursitis may be excited by either direct blows or pressure over the bursæ, or may result from sudden strains imposed on the tendons attached to the bursæ. Repetitive traumas resulting from some special occupation may also excite these reactions. Aside from trauma, acute or chronic bursitides may occur by the localization of an infectious process, much in the same way as particular joints are affected in the non-suppurative arthritidies. An isolated bursitis may occur in the course of rheumatic infections. Since the structure of the bursæ is very simple, inflammation due to different origins manifests itself in identical pathological processes. In some types of bursitis no fluid may be secreted by the endothelial cells and the bursæ may remain painful for years. In others, pain occurs early but disappears as fluid is transuded into the bursal sac. In still others, pain may never be of any consequence as fluid is poured into the sac upon the first insult. The presence of bursitis in this last group will be indicated only by the eventual changes in the neighborhood muscles and nerves. In glancing over the cases reviewed here, it appears that the differences in the clinical picture depend upon the type of bursal reaction.

In Guillain's case of an orchestra leader the presumptive bursitis appears due to chronic traumatism. In Woltman's and Learmonth's third and fifth cases, in the case of Hobhouse and Heald the underlying cause appears to be infectious. In our first case the wrenching of the arm by a crank handle preceded the onset of the paralysis. The constant flexion movements of milking very likely served to aggravate the condition. It is curious that there was not more pain in the elbow at the time of the accident, but if a prompt bursal effusion took place little pain would be expected. The tender point on the forearm now present indicates the probable presence of inflammation in the underlying bursæ.

In Case 2 the constant occupational strain on the left arm and the repetitive jerking movements appear to be adequate traumatic cause for a bursitis. The tender deep seated nodule is strongly suggestive of a bursal cyst.

In addition to those cases in which bursal inflammation may be inferred because of the presence of either pain or tenderness, there are cases in which though these are lacking, other factors suggest that bursal disease may have been present.

Grigoresco and Iordanesco report the case of a young man who had a sprain of the arm and then slept with his head pillowed on this arm. He rapidly developed a paralysis of extension of his thumb and index finger. There was no history of pain and the authors did not specifically mention whether or not tenderness was present. However, the paralysis following trauma is suggestive.

Woltman's and Learmonth's second case was a 37 year old woman who at the age of 13 following a great deal of piano practice developed weakness of the fifth finger and then later weakness of the other fingers. She was not seen until 24 years later. No mention is made of either pain or tenderness, but the long lapse of time makes accurate historical reminiscence unlikely. The association of constant piano exercises with the onset of the paralysis is again suggestive.

Silverstein reports the case of a man who preceding the onset of weakness of the small finger of his right hand used a typewriter which he stated caused "over exertion" of his fingers. In addition he had been playing the violin several hours daily.

No statement is given regarding the occurrence of pain or the finding of tenderness. Certainly the story of constant overuse of the right arm at least provides the basis for the production of a bursitis.

It is noteworthy that of the total of 12 cases now reported, 8 of them were in the right, the arm most commonly used, and in Case 2 the left arm, the one most used, was affected.

In order to support the assumption that paralysis of the dorsal interosseous nerve depends upon its proximity to diseased bursæ and that the anatomical relationships permit this to occur, I refer to a case heretofore unmentioned in the literature of this subject. In 1863 D. Hayes Agnew presented the case of a young woman who over the period of 2 years painlessly developed a paralysis of the extensors of the fingers as well as of the flexors. On deep palpation there was a small deep-seated tender nodule on the inner side of the biceps tendon. Operation disclosed a small bursal cystic sac connected to the bicipitoradial bursa. The median nerve invested the anterior surface and the posterior interosseous nerve was closely applied to and compressed by the posterior wall. Nancrede states that he has seen a case with considerable inability to use the forearm due to the enlargement of the bursa between the origins of the common extensor and the extensor carpi radialis brevis. This caused pressure on the dorsal interosseous nerve. Since the patient of Agnew recovered, it may be that if our hypothesis is true, the changes in the nerve are not as irreparable as we are led to think by the pessimism expressed in the published cases of so called idiopathic paralyses of this nerve.

All evidence appears to indicate that the causes of this unusual phenomenon of an isolated paralysis of a peripheral nerve are interstitial inflammatory and fibrotic changes within it due to the contiguity of diseased bursæ.

Future surgical verification is of course necessary, but this theory provides a logical basis for operative attack.

SUMMARY

Two cases of paralysis of the dorsal interosseous nerve are reported, both showing painful points corresponding to the position of the bicipitoradial and interosseous bursæ of the elbow. An analysis of the 10 cases in the literature appears to show that pain in this region is frequent in association with paralysis of the dorsal interosseous nerve. A bursitis affecting the aforementioned bursæ and involving the contiguous nerve would seem to explain the clinical picture adequately. It is shown that the anatomical relationships of the dorsal interosseous nerve to these two bursæ make this explanation tenable. The histories of all the cases directly or indirectly suggest the probability of a bursitis preceding the onset of paralysis.

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PULSION DIVERTICULA OF THE HYPOPHARYNX

A Review of Forty-One Cases in Which Operation Was Performed and A Report of Two Cases

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DIVERTICULA may occur in any part of the esophagus. In 1840 Rokitansky classified them in two general groups, pulsion diverticula and traction diverticula. The pulsion diverticula are most commonly situated in the hypopharynx, close to the junction of the pharynx and the esophagus; they usually are known as "pharyngo-esophageal" diverticula. In a strictly anatomical classification it would be more correct to classify them as pharyngeal diverticula. However, because of their close proximity to the esophageal orifice as well as the fact that most of the symptoms produced by them are referable to the esophagus, the term "pharyngo-esophageal" is more descriptive for this type of pulsion diverticula. The term "pharyngeal" diverticula should be reserved for those rare types that occur in other portions of the pharynx. Traction diverticula most commonly occur in the true esophagus and will not be considered in this paper.

The pulsion diverticula are the most common diverticula that occur in the pharynx. They have a rather constant situation in the posterior wall of the pharynx, close to the midline, and usually occur at a site of muscular deficiency between the inferior constrictor and cricopharyngeus muscles of the pharynx. The opening is usually situated to the left of the midline although it may occur to the right of the midline.

The uniform situation of these diverticula, which are essentially herniations of the mucous and submucous coats of the pharynx, suggests a possible congenital origin. In this respect they are somewhat analogous to one of the hernias that occurs at the esophageal hiatus, that is, diaphragmatic hernia. In the latter type of hernia an enlarged esophageal ring has been present since birth but the hernia does not develop until later on in life, as a result of constant and increased pressure on the congenitally weak area. There is considerable difference of opinion as to the cause of these diverticula. Many theories have been advanced. Some are based on neuromuscular inco-ordination during the act of swallowing, others have a physiological basis, that is, increased pressure in the posterior part of the pharynx, and others are based on areas of muscular deficiency at the points of entrance of nerves, blood vessels, and lymphatics through the muscles of the posterior wall of the pharynx. It is probable that muscular deficiency is the predisposing cause and that other factors are the inciting causes in the production of the diverticula. This would tend to explain why the symptoms associated with the diverticula are progressive and do not present definite form until late in life.

I have recently reviewed the clinical manifestations in the 227 cases of pharyngo-esophageal diverticulum in which operation was performed at The Mayo Clinic. In 85 per cent of cases the symptoms were vague and indefinite at the onset and were slowly progressive, that is, they had been present 1 to 18 years before they produced any marked disability. In 15 per cent of the cases the symptoms were more rapid in their progress and severity. This difference in the progress of early symptoms of the disease seems to be more related to the character of the neck of the sac than to the size of the sac. In many instances relatively small diverticula which have a small opening produce very marked and disabling symptoms while large diverticula which have a large opening produce relatively little distress and disability because the contents of the sac can be more easily emptied. However, in both of these types, the larger the diverticulum the greater is the severity of the symptoms, which may progress and produce complete esophageal obstruction.

The earliest symptom usually is dysphagia; there is a sensation of some foreign body obstructing the normal process of swallowing and food seems to stick in the throat. Later, there is regurgitation of food and mucus. These symptoms do not occur until a definite sacculation is formed. There often are noisy deglutition and gurgling noises in the throat; these result from the swallowing of air and the collection of food in

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the sac. If the food is not regurgitated the sac can often be emptied by pressure on the side of the neck, especially on the left side, as most of these diverticula project to the left of the midline at about the level of the thyroid gland. After the sac has become rather well developed the progress is rapid because of the increased pressure within the sac, which is caused by the more or less constant presence of food and secretions. The sac pushes downward and backward, between the prevertebral or pretracheal fascia, into the mediastinum and may extend to the arch of the aorta. The largest sac found in any of the cases filled the entire superior mediastinum and held approximately 700 cubic centimeters of fluid. As the diverticulum enlarges it produces progressive esophageal obstruction because the enlarging opening of the diverticulum is pulled downward and forward and obstructs the normal esophageal orifice. This orifice often becomes a narrow slit and may be pushed laterally. The portion of the upper part of the esophagus that is in apposition with the diverticulum is flattened and distorted by direct pressure of the body of the sac. Food enters the diverticulum first and then overflows into the esophagus. In many instances the patients spend hours at their meals in order to obtain enough nourishment to sustain life. The loss of weight may become very great. One patient had lost 100 pounds (45.4 kg.) before coming to the clinic. When the large sacs that extend into the mediastinum are filled with food they produce marked pressure on the adjacent intrathoracic organs and cause a distressing sensation of fullness in the thorax; this sensation is often associated with dyspnea, palpitation of the heart, and a sense of suffocation. Severe cough and choking spells occur frequently and patients many times will lower their heads, as is done in postural drainage, and they will press on the side of the neck in order to empty the sac. In some instances the food will enter the trachea and cause marked cyanosis and may result in a pulmonary complication. There is often an associated hoarseness of the voice; this is caused by pressure or inflammatory reaction around the recurrent laryngeal nerve, which is often close to the neck of the sac.

The symptoms of pharyngo-esophageal diverticulum are definite and characteristic after the sac has been definitely formed, and the diagnosis is readily established. In the earlier stages the symptoms are not definite and a clinical diagnosis may not be established unless an esophagoscopic or roentgenological examination is made. These methods are the most accurate means of establishing a definite diagnosis in all cases. They should be employed in all cases in which there are any persistent signs of dysphagia, as the longer the diagnosis is delayed, the greater is the risk of serious complications which may enhance the difficulties and may impair the results of surgical treatment.

Although these diverticula were first recognized more than 170 years ago by Ludlow (1764), they were not treated surgically until 60 years ago, when Nicoladoni produced a cervical fistula by diverticulotomy. This procedure obviously could not effect a cure. Neihans, in 1884, is said to have been the first one to perform a primary diverticulectomy, but the operation was not successful. The first successful operation for the condition was reported by von Bergmann in 1892. These early operations were associated with a relatively high mortality, chiefly because of mediastinitis, pneumonia, and pulmonary abscess. In many of the cases in which the patients recovered, the morbidity was great because of an esophageal fistula. This led to the two-stage operation, which Goldmann, of Freiburg, is credited with introducing in 1909. After the introduction of this procedure the mortality was greatly reduced. It is now generally accepted that complete extirpation of the diverticulum by operative measures is the only method of treatment that will produce complete relief of symptoms, but there is still considerable difference of opinion as to whether diverticulectomy should be done by a one-stage primary procedure or by a two-stage procedure. The majority of surgeons favor the two-stage procedure but there are many surgeons of equally wide experience who have obtained excellent results with the one-stage procedure.

The purpose of this paper is to report a series of 41 cases in which I have operated for pharyngo-esophageal diverticulum by utilizing both the one-stage and two-stage procedures and to describe the operative treatment.

In this series of 41 cases I utilized both the one-stage and the two-stage operations. It is generally accepted that the only effectual surgical procedure for pharyngo-esophageal diverticulum is the complete removal of the sac, including its neck. In the two operative procedures advocated to accomplish this purpose, the technical difference is in the treatment of the sac and the time at which the sacculation is removed. In the one-stage procedure the sac is removed at the primary operation and in the two-stage procedure a temporary diverticulopexy is performed, and the sac is removed at a second operation 7 to 10 days later. The fundamental difference in these two procedures is that in the one-stage operation

the fascial planes leading to the mediastinum are not walled off preliminary to the removal of the diverticulum. In the two-stage operation the interval between the operations permits the formation of granulations which wall off the fascial planes of the neck and mediastinum.

Because pharyngeal fistula that follows diverticulectomy is one of the most common causes of cervical cellulitis and mediastinitis, an indwelling stomach tube should be inserted before the diverticulum is removed. This permits postoperative feeding. In the one-stage operation the tube is inserted before the primary procedure and in the two-stage operation it is inserted before the second operation.

The method of approach to the diverticulum is the same in both operations. The approach is made on the side of the neck on which the diverticulum is situated, which is usually the left side. In the roentgenogram many of these sacculations appear to be in the midline but the neck of the sac is usually situated to the left or right of the midline. The true situation of the neck of the sac can be best determined by the preliminary esophagoscopic examination. The incision should be made on the side of the neck on which the opening is found. This I believe is important as the exposure of the neck of the sac is greatly facilitated, and there is less risk of injury to surrounding structures, particularly the recurrent laryngeal nerve.

For anesthesia I prefer regional nerve block with procaine. When this method of anesthesia is used the patient's reflexes are not destroyed; this is helpful in safeguarding the patient in many instances. If there is an accumulation of secretions in the sac at the time of operation, these secretions can be carefully emptied into the pharynx; they may either be aspirated by suction or swallowed by the patient. The act of swallowing is often helpful in identifying some of the small diverticula as air is forced into the sac, which permits it to be recognized readily. In the cases in which the diverticula are large there is rarely any difficulty in recognizing the sac. It is also helpful to be able to talk to the patient during the course of the dissection around the neck of the sac posteriorly, because of the close proximity of the recurrent laryngeal nerve. This is particularly true in those cases in which there is considerable inflammatory reaction in the sac and surrounding tissues, which makes visualization of the nerve difficult.

An incision is made through the skin and platysma myoides muscle; the incision extends along the anterior border of the sternocleidomastoid muscle from the hyoid bone above to a point about 3 centimeters above the clavicle (Figs. 1 and 2). The external jugular vein is often in the line of incision; in this case the vein is cut and ligated. The sternocleidomastoid muscle is then separated laterally from the underlying omohyoid muscle. The latter is usually retracted medially or cut; this exposes the carotid sheath laterally, which is retracted outward with the sternocleidomastoid muscle. The thyroid gland is exposed beneath the omohyoid muscle and retracted inward; this exposes the pretracheal fascia which surrounds the trachea and esophagus. In cases in which there is an appreciable hypertrophy of the thyroid gland, it may be necessary to do a partial lobectomy in order to obtain adequate exposure of the fascial coverings of the esophagus. The fascia is then incised posteriorly to the trachea at about the level of the cricoid cartilage. The diverticulum usually is readily localized; it extends downward, laterally and posteriorly, to the esophagus. The fascial coverings of the diverticulum are then carefully dissected away until the true wall of the sac is reached. The fundus of the sac is then carefully elevated into the wound, and the dissection of the remainder of the sac, including its neck, is carried out as it appears through the muscles of the posterior lateral wall of the pharynx, usually between the lower border of the inferior constrictor muscle of the pharynx and the cricopharyngeus muscle. Great care should be exercised in this dissection so as not to perforate the sac at any point or injure any of the surrounding structures, particularly the recurrent laryngeal nerve which is in close relation to the neck of the sac in many instances. It is important not to separate the fascial planes more than is necessary to remove the body of the sac and to make a very accurate separation of the neck of the sac from the surrounding pharyngeal muscles.

Up to this point the technique of both the one-stage and two-stage procedures is identical.

In the first stage of a two-stage operation (Fig. 1) after the diverticulum has been completely dissected from its surrounding attachments, I place a loop of black silk around the true neck of the sac at its junction with the pharyngeal wall; this loop is not tied or permitted to obstruct the neck of the sac in any way. The silk must be very carefully stitched to the outer wall and must not penetrate the wall of the sac. The free ends of this silk loop are brought out of the incision and fastened to the skin. The purpose of this loop is to act as a guide to the neck of the sac so as to insure the accurate removal of the entire sac at

the second operation. It has been my experience that, after the first operation, there is often a marked inflammatory edema not only of the walls of the diverticulum, which become greatly thickened, but also of the surrounding tissues, particularly at the junction of the pharynx. This reaction interferes with an accurate localization of the true neck of the sac at the second operation. I have found this procedure very helpful in obviating this difficulty and it insures against the possibility of excising too much of the sac, which may result in a fistula and subsequent stricture; it also prevents leaving too much of the neck of the sac, which usually causes difficulty and often results in a recurrence of the sac. The diverticulum is then brought out of the upper angle of the wound and sutured to the surrounding muscles in an effort to turn the opening of the sac downward and promote drainage of the sac and to prevent it from becoming filled with secretions and ingested food. A small soft rubber tube and some gauze are placed in the pocket occupied by the diverticulum in the neck or mediastinum and the wound is closed. If the diverticulum is of sufficient size to protrude beyond the skin, that portion of the sac is covered with vaseline gauze. The time of election for the second operation depends on the individual indications in each case. Inasmuch as the purpose of the two-stage procedure is to permit the fascial planes to become walled off, I believe that at least a week should elapse before the second stage of the operation is done and in some instances it is advisable to wait two weeks. At the second operation the diverticulum is carefully dissected from the wound and the black thread that was placed around the neck of the sac is removed. The neck of the sac is then transfixed and ligated with chromic catgut at this point and the sac is excised close to the ligature. The remnant of mucous membrane distal to the ligature is treated with silver nitrate and alcohol and the stump is dropped back. A gauze and tube drain is placed below the stump and the wound is closed with interrupted sutures. The patient is not permitted to take anything by mouth for at least 1 week, but is fed through the indwelling stomach tube which was inserted through the nose.

In the one-stage operation the true neck of the sac is transfixed and ligated with chromic catgut after the sac has been completely dissected free from the surrounding structures (Fig. 2). The redundant mucous membrane is treated with silver nitrate and alcohol and is then dropped back. The muscle of the wall of the pharynx, which surrounds the neck of the sac, is loosely approximated with interrupted sutures of catgut. A gauze drain is placed in the pocket formerly occupied by the diverticulum and a soft rubber tube is placed down to the repaired pharyngeal wall; the wound then is closed with interrupted sutures. The patient is fed entirely through an indwelling stomach tube for 7 to 10 days.

In this series of 41 cases, 29 of the patients were men and 12 were women. The average age of the patients was 58 years. The youngest patient was a man, aged 35 years, and the oldest patient was a woman, 73 years of age. The interval between the onset of symptoms and the operation varied from 9 months to 18 years; the average interval was more than 5 years. In 1 case, in which the patient was 65 years of age, a diagnosis of pharyngo-esophageal diverticulum had been made 18 years before the patient came to the clinic for emergency treatment of acute complete esophageal obstruction and associated weakness and emaciation that had been caused by the loss of 100 pounds (45. 4 kg.). Two attempts were made to pass a stomach tube through the esophagus with the aid of an esophagoscope, but it was impossible to locate the esophageal orifice because of inflammatory edema. It was necessary therefore to do a gastrostomy in order to feed the patient preliminary to operation. In 5 other cases it was necessary to insert an indwelling stomach tube through the esophagus for feeding preliminary to operation.

The operative procedure was a complete diverticulectomy in all cases. In 25 cases the sac was removed by a two-stage operative procedure; the sac in most of these cases was large and extended into the mediastinum in many instances. In some cases there was an associated diverticulitis. In 16 cases the sac was removed by one-stage operation; in all of these cases the sac was small to moderate in size and in only 1 case did the sac extend into the superior mediastinum. In 2 cases a partial thyroidectomy was done at the time of the first operation.

There was 1 operative death in the entire series. In this case death followed a two-stage procedure; there had not been any leakage from the sac or pharynx. The patient was in poor physical condition not only because of the large pharyngo-esophageal diverticulum, which had caused marked esophageal obstruction, but also because of arteriosclerosis of the central nervous system and a well advanced Parkinson's syndrome. A marked psychosis developed on the third postoperative day. There were swelling of the throat, a temperature of 102 degrees F. on the fifth day after operation, and moderate drainage

from the wound. The condition of the patient became progressively worse; by the ninth day after operation the diverticulum had become somewhat necrotic. It was removed and the wound was explored. That portion of the diverticulum below the margin of the skin was not necrotic, and there had been no leakage. There was a marked cellulitis in the cervical region with a moderate mediastinitis. The removal of the sac and exploration of the wound did not influence the progress of the condition in any way. The condition of the patient became progressively worse and he died on the eleventh day after the initial operation. The immediate cause of death was a terminal pneumonia. A roentgenogram of the lungs, which was made on the sixth day after the operation, reveals no abnormality. While this death is charged to the operation (two-stage operation) there were many unrelated contributing factors, and the result would probably have been the same, regardless of the type of operation. The fact that there was considerable cervical cellulitis indicates that the multiple-stage procedure may not entirely protect against this possible complication.

In 3 cases hoarseness occurred following a two-stage operation. In 2 cases the hoarseness was temporary and there was no paralysis of the vocal cords, but in 1 case there was a paralysis of the left vocal cord, which was caused by injury of the recurrent laryngeal nerve. In 1 case temporary hoarseness occurred following a one-stage operation.

The average duration of convalescence before dismissal of the 25 patients who were subjected to two-stage operations was more than 5 weeks. A temporary fistula developed in 6 cases; in all of these cases it healed without further surgical intervention, in 1 week to 2½ months. The average duration of postoperative convalescence before dismissal of the 16 patients who were subjected to a one-stage diverticulectomy was a little less than 3 weeks. Postoperative complications occurred in only 1 of the cases in which the one-stage operation was employed. In this case temporary pharyngeal fistula developed. This fistula was probably precipitated by the patient drinking a considerable quantity of fluids the second night after the operation although he was instructed not to do so. The fistula persisted for 3 weeks and then healed. In 1 additional case there was a moderate amount of seropurulent drainage. In the 14 remaining cases, the wounds healed by first intention.

The results following the one-stage operative procedure have been very satisfactory, and because of the shortened convalescence and lessened discomfort in eliminating one operative procedure, I believe that the one-stage procedure should be utilized in all cases in which it is indicated.

I see that a roentgenogram of the esophagus is made in all cases before the patients are dismissed from the hospital and I request all patients to return in 6 months to a year for re-examination. All but 7 of the patients in this series of cases have returned for examination at some time following operation; the examination has included a roentgenogram of the esophagus. All but 4 patients have either returned for examination or replied to a letter of inquiry as to their condition in the 6 months before this paper was written.

The late results following the two-stage operation have not been as satisfactory as those following the one-stage operation.

In 2 cases in which the two-stage operation was employed the diverticulum has recurred 1 to 2 years after operation. In 1 of these cases the patient had a large adenomatous thyroid. There were 5 patients who had some difficulty in swallowing certain types of food; these patients stated that they had a sticking sensation in the throat. No definite recurrence or stricture was found on subsequent examination but a slight angulation was found at the site of the removal of the neck of the sac; in 4 of the cases in which this occurred symptomatic relief was obtained by dilatation. In the fifth case, the symptoms were partially relieved by dilatation. There were 8 patients who did not receive complete relief from the original operation, but 4 of these were subsequently relieved by dilatation. It is of interest to note that in 6 of these 8 cases the diverticulum was classified as small or moderate in size. There were only 2 cases of large diverticulum in which a good result was not obtained.

REPORT OF CASES

CASE 1. A man, aged 50 years, came to the clinic July 23, 1931, because he regurgitated ingested food. Ten years before this, he had noted that a large amount of mucus accumulated in his throat during the night, and he would have to expectorate before he could eat breakfast. Later, he had noted that food taken during the day would be regurgitated at night. He complained chiefly that food did not reach his stomach until enough of it had been taken seemingly to fill a pouch in the right side of his neck. After this pouch was filled, the food seemed to overflow into his stomach. He had learned to empty this pouch of retained food by applying pressure to the right side of his neck and to wash out the pouch with water. Until 2 years before his admission, he had been able to maintain his weight rather well by eating at frequent intervals and by taking considerable time at his meals. In the last 2 years before he came to the clinic he had had increased difficulty

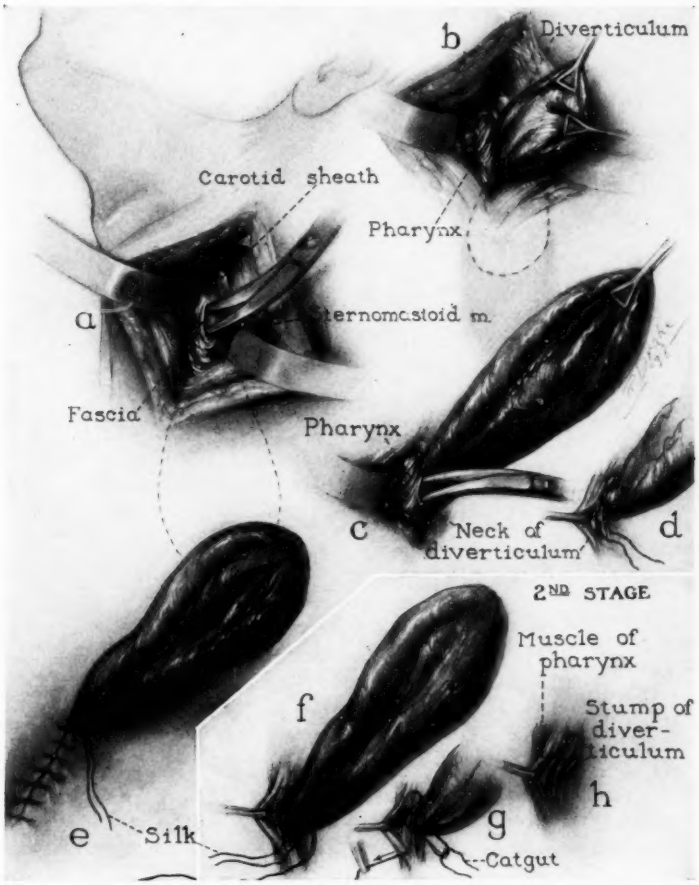

Fig. 1. Two-stage operation; a, incision along anterior border of sternomastoid muscle and incision of the peritracheal fascia over the diverticulum; b, beginning dissection of the diverticulum from the superior mediastinum; c, dissection of the neck of the diverticulum at the pharyngeal opening; d, neck of the sac marked with black silk; e, diverticulum sutured outside the wound. Second stage of operation; f, placing black silk around the neck of the diverticulum; g, ligating the diverticulum with catgut; h, closure of opening in the pharynx around the neck of the diverticulum.

in swallowing and in getting sufficient food into his stomach to maintain his general condition. The regurgitation increased progressively and he had had increased difficulty in taking both liquid and solid food. During the month before his admission, his condition had become much worse than it had been and he had lost about 13 pounds (5.9 kg.). His normal weight was 106 pounds (48.1 kg.).

General examination was essentially negative. Roentgenographic and roentgenoscopic examinations of thorax disclosed a very large diverticulum of upper third of esophagus (Fig. 3). The diverticulum extended into the right thoracic cavity. A diagnosis of pharyngo-esophageal diverticulum was made. A two-stage operation was advised.

A Rehfuss tube was inserted through the esophagus into the stomach for postoperative feeding. Operation on July 29 revealed a large esophageal diverticulum which extended deep into the mediastinum on the right side. The diverticulum was completely dissected from the surrounding structures and was brought through the wound in the right side of the neck. The sac was left protruding from the wound and the neck of the sac was sutured to the sternocleidomastoid and sternohyoid muscles (Fig. 4). The second stage of the operation was done 12 days later. At this time the sac was entirely removed (Fig. 5), the neck of the sac was inverted, and the opening of the sac into the esophagus was completely closed.

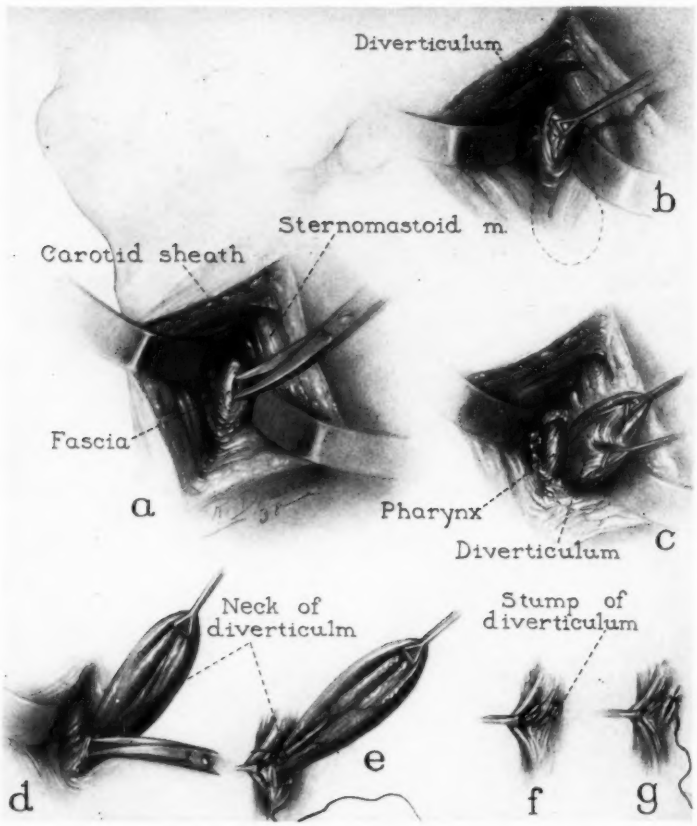

Fig. 2. One-stage operation; a, incision around anterior border of sternomastoid muscle with opening of the peritracheal fascia over the diverticulum; b and c, dissection of the diverticulum from the peritracheal fascia; d, dissection of the neck of sac at the opening in the pharynx; e, dissection and ligation of the neck of the sac with chromic catgut; f and g, closure of the opening in the pharynx with chromic catgut.

Convalescence was uneventful. For 10 days following removal of the diverticulum the patient was fed through the Rehfuss tube which had been inserted through the esophagus before operation. He had a slight increase in temperature for about 3 days but the temperature then dropped to normal and remained so throughout the remainder of the convalescence. A moderate amount of seropurulent material continued to drain from the wound for about 2 weeks, when the wound gradually closed. After removal of the Rehfuss tube, the patient swallowed food without difficulty, and there was no fistulous opening. When he was dismissed from observation, 33 days after the operation was performed, the wound was completely healed (Fig. 6).

A roentgenographic examination of the esophagus 2 days before his dismissal gave evidence of complete removal of the esophageal diverticulum; there was no obstruction or sacculation.

In this case I believe that a two-stage operative procedure was indicated because of the poor general condition of the patient (which was the result of his inability to obtain sufficient nourishment) and chiefly because of the type of pharyngo-esophageal diverticulum which was present. A huge diverticulum filled the anterior portion of the superior mediastinum and extended to the arch of the aorta. There was marked diverticulitis. These factors were responsible for the marked esophageal obstruction, loss of weight, and poor general condition, which necessitated preparation before surgical intervention could be undertaken.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 3. Roentgenogram made in Case 1 at the time the patient was admitted to the hospital; this shows a large pharyngo-esophageal diverticulum that fills the entire superior mediastinum and the upper part of the thorax.

Fig. 4. Photograph of patient in Case 1, made 3 days after completion of the first stage of the operation.

Fig. 5. Pharyngo-esophageal diverticulum removed in Case 1.

Fig. 6. Patient in Case 1, at the time of his dismissal from the hospital.

CASE 2. A man, aged 49 years, came to the clinic on July 26, 1937, because of dysphagia. About 2 years before this, he had first noted that food and liquids would lodge in the upper part of the esophagus and he would at times have to regurgitate a small amount. In December, 1936, 8 months before he came to the clinic, a diagnosis of pharyngo-esophageal diverticulum had been made. There had been no change in his voice or any loss of weight. About 12 years before he came to the clinic a total left pneumothorax had been performed and a diagnosis of pulmonary tuberculosis made. He had been placed on an antituberculous regimen and had continued this until he came to the clinic.

The patient weighed 132 pounds (59.9 kg.). Examination of the thorax revealed hyperresonance and rather distant breath sounds. There was pressure over the base of the neck. These findings were typical of pharyngo-esophageal diverticulum. Roentgenological examination of the thorax disclosed a pharyngo-esophageal diverticulum of moderate size (Fig. 7), a healed tuberculous lesion which was situated anteriorly at the level of the fourth rib on the right side, and congenital cysts which involved a large part of the upper lobe of each lung. A diagnosis of pharyngo-esophageal diverticulum was made and a one-stage operation was performed. A French sound was passed and it was found that the mouth of the sac was wide open. There was no evidence of growth in the bottom of the sac nor of esophageal obstruction below the diverticulum.

A Rehfuss tube was inserted through the esophagus and into the stomach for postoperative feeding. Operation on July 31, 1937, revealed a diverticulum underneath the lower pole of the thyroid gland. The diverticulum had a rather definite neck. It was completely isolated from the surrounding structures; a catgut pursestring suture was passed around the diverticulum, and the diverticulum was completely excised. The stump was transfixed upward. Microscopic study revealed an esophageal diverticulum which measured 2.5 by 1.5 centimeters.

Convalescence was uneventful. There were no postoperative complications, and the patient was dismissed from the hospital on the fourteenth day after the operation (Fig. 8) and was allowed to return to his home on the seventeenth day. At that time the wound was entirely healed and the roentgenogram of the esophagus did not reveal any abnormality (Fig. 9).

In this case I believe that a one-stage operation was indicated because the patient's general condition was good, and there had been no loss of weight and no definite esophageal obstruction. The diverticulum was of moderate size, extended only slightly into the superior mediastinum, and had a small neck.

SUMMARY

A two-stage operation was employed in 25 cases. There was 1 operative death in this group of cases. In 21 cases the patients obtained permanent relief, and in another case the patient obtained temporary relief but the symptoms eventually returned. In 2 cases the diverticulum returned. A postoperative fistula occurred in 6 cases in which the two-stage operation was used.

There was no recurrence of symptoms in the 16 cases in which a one-stage operation was employed. When 1 patient was examined 1 year after the operation he said that he had been entirely relieved of any difficulty in swallowing, but that he occasionally had noted an accumulation of mucus in the back of his throat. There was no evidence of recurrence of the diverticulum. Dilatation of the esophagus relieved the accumulation of mucus. In the 16 cases in which the one-stage operation was employed the diverticula were small or moderately large. There was no operative mortality in this group of cases.

Fig. 7.

Fig. 7. Roentgenogram made in Case 2 at the time the patient was admitted to the hospital; this shows a moderately large esophago-pharyngeal diverticulum in the upper part of the thorax and extending slightly to the right of the midline.

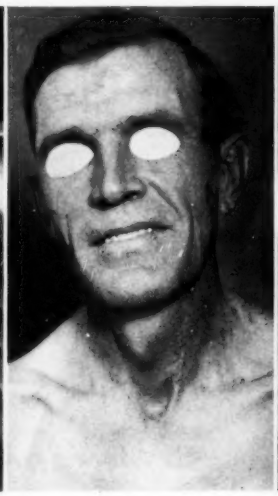

Fig. 8.

Fig. 8. Patient in Case 2, at the time of his dismissal from the hospital.

Fig. 9.

Fig. 9. Roentgenogram made in Case 2 at the time the patient was dismissed from the hospital; this shows that the esophagus is normal.

It is not my intention to offer this summary as a comparison of the results obtained with one-stage and two-stage operations. The entire series of cases is too small to permit an evaluation of these operative procedures. Furthermore, the number and character of the diverticula and the condition of the patients were not the same in the two groups of cases in which these respective operative procedures were employed. However, this review does indicate that there is a group of cases in which the one-stage operation will produce excellent results. In the majority of cases in which the two-stage operation produced poor results the diverticula were rather small. This is the reason that I selected the one-stage operation in this type of case; the results have been very gratifying. It may be that the results of the one-stage operation would be equally satisfactory in some cases in which the diverticula are large but I do not believe that a one-stage procedure should be done in cases in which a large diverticulum extends deep into the mediastinum and is complicated by inflammatory edema and prolonged esophageal obstruction.

I believe that both operative procedures have a definite place in the surgical treatment of pharyngo-esophageal diverticulum and that the surgeon should utilize the procedure which is most suitable to meet the indications in each individual case. It is doubtful if the best results can be obtained by utilizing one operative procedure in all cases. The selection should depend on the condition of the patient, the character and pliability of the diverticulum, the size of the defect in the pharyngeal wall, and the type of opening in the sac. In the case in which death occurred after a two-stage operation the diverticulum was complicated by a cervical cellulitis and mediastinitis. This cellulitis was not entirely responsible for the fatality but it at least was a contributing factor. This shows that the two-stage procedure does not always protect against this most dreaded complication of all esophageal operations and proves that the two-stage procedure may give a false sense of security. I do not believe that the fear of the possible development of this postoperative complication should be the only indication for the selection of the type of procedure to be utilized in the treatment of these diverticula. It is possible for this complication to occur following either operative procedure.

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THE TREATMENT OF CARCINOMA OF THE UTERINE CERVIX

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IT HAS become definitely established by this time that carcinoma of the uterine cervix is curable in a significantly large proportion of cases by radiation therapy. Surgery is now but rarely employed in the treatment of cervical carcinoma except for the adenocarcinomatous variety. This and the fact that the initial radiation treatment administered to any patient usually determines the outcome have led us to present in some detail the plan of therapy employed for this condition at the Tumor Clinic of the Michael Reese Hospital.

All patients with suspected or proved carcinoma of the cervix are referred to the Tumor Clinic. Each patient is seen by a gynecological consultant and the radiotherapist who plan the management of the case jointly. Abdominorectovaginal examination is performed and the extent of the disease ascertained. The system of anatomical classification employed is somewhat similar to that adopted by the League of Nations Commission for the study of cervical carcinoma. Lesions confined to the cervix, anterior and/or posterior lips, with no involvement of paracervical or parametrial tissues and strict preservation of cervical and uterine mobility, are designated as Group I (Fig. 1). Carcinoma spread to the vaginal wall, including the fornices, vault, etc., without parametrial involvement constitutes Group II (Fig. 1). Invasion of one or both parametria characterizes Group III (Fig. 1). Group IV consists of those patients with inguinal or iliac lymph gland metastasis, invasion of adjacent organs, or distant metastases (Fig. 1). The anatomical extent of the disease is an important prognostic index. In the Group I cases, cure may be anticipated in from 60 to 70 per cent of cases; whereas, in Group II the curability drops to about 40 per cent. The salvage of Group III cases amounts to from 15 to 25 per cent, while that of Group IV is nearly negligible. The determination of the anatomical extent of the disease is of some importance in planning the therapy, for the cases with extensive paracervical and parametrial infiltration will require larger doses of external radiation aimed at the parametrial tissues than will those tumors apparently confined to the cervix.

All cases of Groups I, II, and III are accepted for the complete course of radiation therapy. Group IV tumors are usually not treated unless there is severe pain of sciatic distribution or excessive bloody or purulent discharge, in which case external radiation is administered for palliative purposes. In advanced cases with severe, otherwise uncontrollable, hemorrhage preliminary extraperitoneal bilateral hypogastric artery ligation is recommended.

Punch biopsy is performed in every case at the outset of treatment. In early or suspected cases of carcinoma of the cervix, without gross tumor or ulceration, the Schiller test is performed. The test can do no more than point out a zone of pathological tissue deficient in glycogen content and consequently not staining brown with the Lugol's iodine solution. However, in the absence of visible or palpable tumor, or ulceration, this test will sometimes indicate the area that should be selected for biopsy. An attempt is made to grade each tumor as to its degree of malignancy. The general criteria of Martzloff and Broders are employed in grading the epidermoid neoplasms. The hornifying squamous epithelioma with few mitotic figures and with close resemblance of the tumor cells to one another is designated as Grade I (Fig. 2). The squamous carcinoma with zones of transitional cells or the transitional cell carcinoma

From the Tumor Clinic, Erich Uhlmann, M.D., Director, of the Michael Reese Hospital.

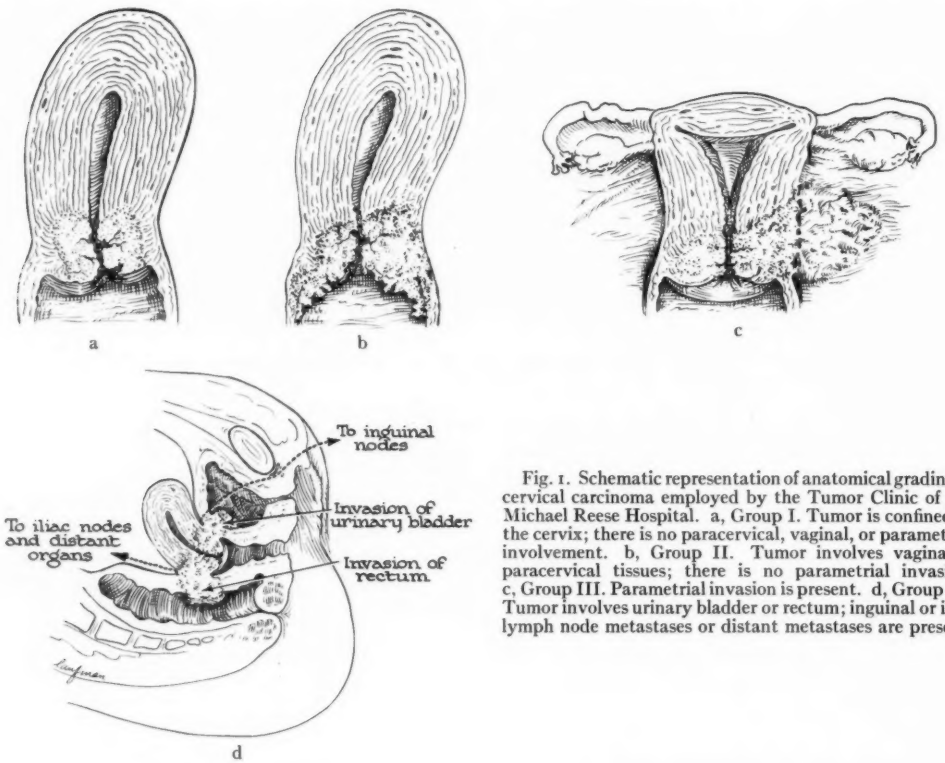

Fig. 1. Schematic representation of anatomical grading of cervical carcinoma employed by the Tumor Clinic of the Michael Reese Hospital. a, Group I. Tumor is confined to the cervix; there is no paracervical, vaginal, or parametrial involvement. b, Group II. Tumor involves vagina or paracervical tissues; there is no parametrial invasion. c, Group III. Parametrial invasion is present. d, Group IV. Tumor involves urinary bladder or rectum; inguinal or iliac lymph node metastases or distant metastases are present.

with squamous features is classified as Grade II (Fig. 2). Our Grade III is the pure transitional cell variety (Fig. 2). Complete anaplasia, with no attempt at recognizable architectural structure, with the largest number of mitotic figures and the greatest degree of individual cellular variation as to size, shape, and staining qualities characterizes Grade IV (Fig. 2). Grade I is least invasive, Grade IV most highly invasive, while Grades II and III have intermediate degrees of malignancy. We have not been able to demonstrate any constant relationship between degree of malignancy and radiosensitivity. In general, we have found all epidermoid neoplasms of the cervix to be radiosensitive.

Cervical culture is made routinely before the administration of intra-uterine radiation. If the hemolytic streptococcus is found, intra-uterine radiation is delayed until the cervical culture has become negative for this organism.

Since one course of radiation often produces local radio-immunity or radioresistance to future radiation, the first cycle of treatment must be planned to sterilize the tumor; if this has not been accomplished during the first attempt, all future trials will at best be palliative in effect and not curative. In this respect, the rate of administration of the energy is of extreme importance. The so called caustic method of radiation, the administration of a single massive dose at one sitting, has been abandoned. It is now recognized that tumor cells are most radiosensitive during the phase of cell division or mitosis; and since different neoplastic cells within the same tumor may be in mitosis at different intervals, it is important to deliver the radio-active energy over a protracted period of time in order to expose the maximum number of cells undergoing mitosis to the radiation. On the other hand, it is important not to exceed a certain tolerance dose beyond which edema of the soft tissues surrounding the tumor occurs, making for radioresistance. While protraction of the treatment is considered necessary, excessive prolongation with insufficient daily in-

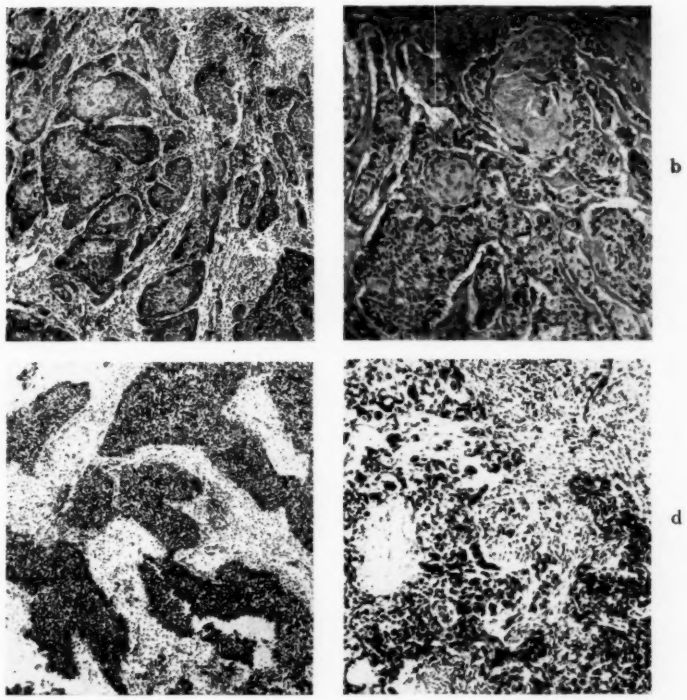

Fig. 2. a, Grade I epidermoid carcinoma of cervix. Hornifying squamous pearls are numerous. ×27. b, Grade II epidermoid carcinoma of cervix. The lesion shows transitional cell as well as squamous features. ×68. c, Grade III epidermoid carcinoma of cervix. Histological structure of purely transitional cell variety. ×27. d, Grade IV epidermoid carcinoma of cervix. This is the totally anaplastic and most highly invasive variety of cervical carcinoma. ×45.

tensity will usually not produce a tumoricidal effect. The optimum period of treatment is thought to be from 40 to 60 days.

The choice of the radio-active agent, whether radium or x-rays, is less important than the technique of radiation. In this clinic radium element has been employed for the intra-uterine and vaginal radiation; while the external radiation has been administered either with the 4 gram radium pack or with a 200 kilovolt deep x-ray therapy machine. Recently, a special tube has been developed for use in the accessible body cavities with which it is possible to administer roentgen therapy intravaginally. As for the external radiation employed there are certain desirable features about the radium pack. The wave length of the γ-ray is shorter and consequently more penetrating than the shortest x-ray obtainable with the usual 200 kilovolt apparatus. This leads to more selective destruction of neoplastic cells and better preservation of uninvolved tissues. In addition, the rate of delivery of the energy is much slower than with x-rays. On the other hand, with higher tension voltage it is possible to produce shorter wave length x-rays with physical and biological characteristics resembling the γ-ray.

The parametrial tissues are always irradiated whether they are clinically involved by tumor or not. The sequence of treatment, intra-uterine, vaginal, or external, depends primarily on the anatomical disposition of the tumor. Each case is an individual problem and the technique and dosage are varied accordingly. However, certain general principles are followed in the management of cases of cancer of the cervix and these principles are presented in some detail. If the vagina is filled with tumor and the cervical canal occluded, external radiation is administered first (Fig. 3). On bimanual examination the parametria are projected to the skin anteriorly and pos-

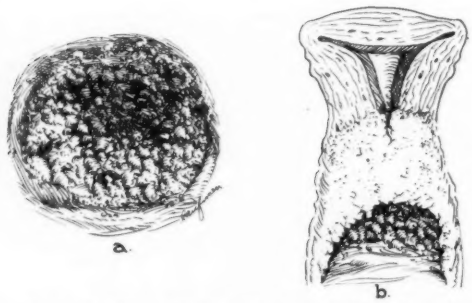

Fig. 3. Carcinoma of the uterine cervix with obliteration of the uterine canal and the fornices: a, as seen with vaginal speculum; b, schematic cross-section. In dealing with this type of lesion external radiation is selected as the initial mode of treatment. It is also possible to begin with a specially molded vaginal radio-active applicator.

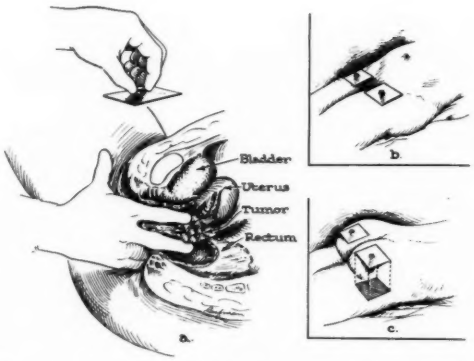

Fig. 4. a, Rectovaginal examination to localize parametrial tissues in relation to overlying skin areas; b, anterior projection of parametria to anterior ilio-inguinal skin areas; c, posterior projection of parametria to gluteal skin areas. Usual size of portals is 11 by 11 centimeters; sometimes more than 4 fields are employed, especially if there is marked parametrial involvement.

teriorly (Fig. 4). Two anterior iliac and two posterior gluteal fields are marked out. These fields must be separated by at least 1 centimeter in the midline to prevent overlapping and excessive damage to the tissues in the midline. The pudendal field is usually not employed as the skin in this region becomes readily macerated and will not stand much radiation. About 3000 milligram hours are administered daily to each of two fields for a total daily dose of 6000 milligram hours. The radium is in the form of 4 grams of element filtered by 1 millimeter of platinum and kept at a distance of 10 centimeters from the skin. The size of each field is 8 by 10 centimeters. The treatments are given 6 days a week and the four fields are treated in succession. The patient is advised to douche with 1:5000 potassium permanganate 3 times daily, and is examined twice weekly. If the intravaginal disease regresses to the point of permitting intravaginal or intra-uterine treatment, the external radiation is temporarily interrupted and the patient is admitted to the hospital for the intracavitary treatment. If, however, such regression does not take place, the external radiation is continued until the height of the skin reaction, which usually occurs about 26 to 32 days after the beginning of treatment. By this time the patient has received about 50,000 milligram hours to each of four pelvic fields for a total of 200,000 milligram hours. If the primary lesion has not regressed enough to permit intracavitary treatment with this amount of external radiation, the prognosis is generally hopeless. If x-rays are employed for the external treatment instead of radium, the dose is usually 200 r to each of two pelvic fields daily. The 200 kilovolt machine is employed using 1 to 1.5 millimeters of copper filtration or its equivalent, as Thoraeus or Thoraeus A. The skin-target distance is 50 centimeters; the fields are 11 by 11 centimeters. A total of 1600 to 2000 r is given to each of 4 pelvic fields, the treatment usually being completed in 24 to 28 days. The x-ray treatment is similarly interrupted for intracavitary treatment if this becomes possible during the cycle of external radiation. Though skin, cervix, and vagina are all of epidermoid structure, the radiation reaction of the latter 2 usually precedes that of the skin, reaching its height from 14 to 20 days after the beginning of treatment. This reaction is known as epithelitis and consists of a pseudodiphtheritic fibrinous yellowish membrane overlying the tissues of the tumor, the remainder of the cervix, and the vagina. It is a good prognostic sign if epithelitis over the tumor site precedes and is more intense than the epithelitis over the adjacent tissues. It is a distinctly poor omen if the epithelitis over the tumor develops later than that of its surrounding tissues.

The external radiation is designed primarily to reach the cells in the parametria which cannot be adequately destroyed by the intracavitary treatment. The treatment of the primary cervical tumor is accomplished by a combination of intra-uterine and intravaginal treatment. If, at the outset of treatment, the fornices are not obliterated such intracavitary radiation is administered before the external treatment (Fig. 5). If the uterine canal is patent and the culture of the cervical secretions negative for hemolytic streptococcus, a tandem or intra-uterine applicator and a

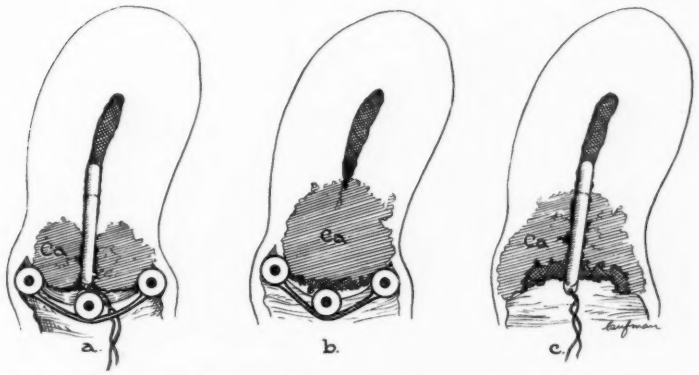

Fig. 5. a, Technique of intracavitary treatment for carcinoma of the cervix in which the uterine canal is patent, fornices are not obliterated, and uterine culture is negative for hemolytic streptococcus. Intra-uterine tandem and vaginal colpostat are employed simultaneously as initial treatment. b, Uterine canal is not patent but the fornices are preserved. Vaginal colpostat is usually selected as the initial treatment. It is also possible to use a specially molded radio-active applicator placed against the cervix. c, Uterine canal is patent but the fornices are obliterated. If uterine culture is negative for hemolytic streptococcus, intra-uterine tandem is employed as initial treatment. As in b, it is also possible to begin with a specially molded radio-active applicator placed against the cervix.

colpostat or vaginal applicator are inserted simultaneously. Fifty milligrams of radium filtered by 1 millimeter of platinum and 1 millimeter of aluminum is placed in the uterine canal and the colpostat is inserted vaginally. The latter apparatus consists of three rubber corks each containing 10 milligrams of radium filtered by 1 millimeter of platinum. One cork is left in each lateral fornix and the third is placed anteriorly to the cervical os. With such an arrangement the cervix is crossfired from multiple sources. The parametria also receive some radiation from the colpostat although 50 per cent of the intensity is lost at a distance of 4 centimeters from the colpostat cork. The abdomen must be palpated and percussed frequently to make sure that the bladder is constantly empty, otherwise a severe cystitis may develop. If the bladder remains empty and the patient is comfortable and afebrile, the colpostat may be kept in place until the tandem is to be removed. This is usually 70 hours after its insertion for a total tandem dose of 3500 milligram hours. Then the colpostat is reinserted and kept in place until it has remained for a total of 116 hours for a dose of 3500 milligram hours. If the patient is uncomfortable, if there is any elevation of temperature, or if the bladder and rectum are not emptied spontaneously, the colpostat is changed daily. If the temperature rises to 102 degrees, the intracavitary treatment is discontinued.

Following the completion of the intracavitary treatment external radiation is immediately begun, as outlined. After the intracavitary treatment the patient is instructed to douche with potassium permanganate three times daily. However, the douching should not be started prior to 48 hours following the removal of the intra-uterine tandem, for while the canal is patent douching may result in pelvic peritonitis.

If hemolytic streptococcus is found on cervical culture, the intra-uterine tandem is not inserted despite patency of the uterine canal but the colpostat, alone, is selected as the initial treatment. On the other hand, if the fornices are obliterated but the uterine canal is patent, as occasionally happens, it may be necessary to begin with the intra-uterine tandem and postpone the colpostat until the fornices have opened. In such cases it may at times be desirable to give a larger initial intra-uterine dose. On the other hand, if following colpostat and external radiation the uterine canal remains closed, it may be desirable to give a small additional dose with the colpostat.

Following the completion of radiation therapy, pelvic examination is performed weekly until the radiation reaction regresses. The weekly examination at this time is extremely important for fine pericervical adhesions often develop with the subsidence of the epithelitis and unless these are repeatedly broken up by the examining finger

troublesome intravaginal fibrosis may result. When all evidence of disease has disappeared and the tissues have returned to normal consistency, the patient is instructed to return for follow-up examination every three months. Six months following the disappearance of all evidence of tumor the resumption of sexual intercourse is permitted.

Severe backache or pain of sciatic distribution due to original or recurrent parametrial invasion is treated by subarachnoid injection of absolute alcohol according to the Dogliotti technique. This has proved to be a most satisfactory procedure for pain of somatic distribution. We have not observed relief when the pain has been due to rectal or vesical invasion or to ureteral obstruction with hydronephrosis.

For adenocarcinoma of the cervix, which constitutes but 3 per cent of all cases of carcinoma of the cervix, radical Wertheim hysterectomy is recommended followed by external deep radiation, provided the tumor is still confined to the cervix without parametrial invasion. If such invasion has already occurred, the tumor is treated like epidermoid carcinoma of the cervix, the complete course of intracavitary and external radiation being administered.

Two factors of paramount importance in the treatment of cancer of the cervix have received far too little emphasis. These are: (1) the importance of early diagnosis and institution of therapy in the curable stages of the disease, and (2) the possibility of preventing the development of the disease in a majority of cases.

A recent authoritative study by a special committee of the League of Nations based on nearly 700 cases of cervical carcinoma seen and treated at the outstanding European clinics indicates that there is at least 63 per cent probability of 5 year freedom from disease following the treatment of Grade I tumors, or those limited to the cervix. Unfortunately, only 9 per cent of all patients with cancer of the cervix come for treatment in this early curable stage. Over 50 per cent of the patients seen and treated have already advanced to Grades III or IV at the time of the first examination and the curability of such cases is only 12 to 23 per cent. The importance of the early diagnosis and administration of appropriate therapy in the first stage of the disease is obvious. This entails frequent periodic examination by a competent gynecologist of all women, whether presenting gynecological symptoms or not. It means not only manual examination but visual inspection of the cervix, preferably with the Hinselmann colposcope. The magnification possible with this instrument will frequently demonstrate ulcerations which could not be detected by the unaided eye or even with the Schiller test. Such periodic examination will establish the diagnosis of cervical cancer in the first stage of the disease in many cases which might otherwise have passed asymptomatically into less auspicious stages. Another factor of importance is the routine performance of diagnostic curettage preliminary to supracervical hysterectomy. This procedure will minimize the occurrence of stump carcinoma and will avoid the inadvertent transection of the uterus through an isthmic carcinoma promoting the dissemination of cancer cells into freshly opened blood vessels and lymphatics.

The obstetrician and gynecologist occupy the key positions not only in the establishment of early diagnosis but in the prevention of cancer of the cervix, which is even more important. The disease is frequently preceded by cervicitis of venereal or obstetrical origin. In other cases abortions may be a contributory factor. The development of cancer of the cervix without antecedent childbirth, curettage, or venereal infection must indeed be rare. Similarly, one seldom encounters the disease in a cervix which has been cauterized surgically for cervicitis.

The steps to be taken for intelligent and effective prophylaxis are obvious: avoidance of unskilled midwifery, competent obstetrical attention at childbirth, prompt repair of birth trauma to the cervix, education of the public in the prevention of venereal diseases, thorough surgical cautery for chronic cervicitis and, as mentioned before, periodic manual and visual examination of the cervix. With such a program cancer of the cervix will become not only a relatively benign, curable disease, but a rare disease as well.

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EDITORIALS

SURGERY
Gynecology and Obstetrics

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SEPTEMBER, 1939

WILLIAM J. MAYO

THE Editors of SURGERY, GYNECOLOGY AND OBSTETRICS received with sorrow the announcement of the death of William J. Mayo. Closely associated with the founder of this Journal from its inception, he served as the chief of the Editorial Board for many years, during which time he contributed most generously of his time and thought. It will be difficult for anyone to measure in words his fame and influence upon the surgical world. With his brother, he introduced and directed a method of practice in medicine which, aside from his many scientific contributions, will insure his place in American surgery.

CARCINOMA OF THE CERVIX

THE treatment of cervical carcinoma in America in 1916 was almost entirely surgical. About that time radium was introduced and in a few clinics favorable results were being obtained. At all gynecological society meetings discussions were held that predicted on the one hand the entire elimination of surgery and on the other hand, after trial, a renewed interest in the surgical attack. For many years the radiological approach has now been used and the results are much better than the anticipated ones. In the last few years in many clinics throughout the world roentgen treatment has been added to the radium treatment and the results at this writing are apparently better than with radium alone. There are still those who advocate the radical surgical extirpation of the uterus, adnexa, and lymph node drainage areas, but these advocates limit surgery to those patients in good condition with early and localized disease. It is generally admitted that radiation is the proper procedure in all but the earliest cases. The argument for surgery is that patients treated with radiation die from cervical cancer after 5 years of freedom from disease—whether this is due to recurrence or reoccurrence of the disease is not clear. In a large cancer hospital, such as the Pondville Hospital of the Massachusetts State Department of Health, very few patients have been seen or sent to the hospital who have developed cancer after a supposed 5 year "cure." No doubt patients die after 5 years following treatment but most deaths occur because of persistence of disease, not its reappearance after complete clinical "cure." Before one advocates, even in the early cases, radical surgery or surgery after radiation treatment, it will be necessary to accumulate material proving that late occurrences are due to dormant disease that could have been eradicated by operation. It is possible that small recurrences may be due to persistent disease yet

even complete surgical removal does not guarantee a cure. It is difficult to prove the necessity for radical and unquestionably dangerous surgery unless radiation failures are greater than recurrences following surgery in similar cases.

The use of preliminary roentgen-ray treatment opens a new era in the management of this disease. This treatment, if given in large amounts by the 200 kilovolt machine, combined with moderate doses of radium, has proved of extreme value and the results of such treatment show improvement. No doubt the higher voltage machines plus radium will still further aid in the cure of this lesion.

In a series of three papers from the gynecological, urological, and pathological departments of the Pondville Hospital, an attempt has been made to analyze 70 cases carefully and to report important clinical deductions. The value of the Pondville method of treatment, the seriousness of renal complications, and the importance of multiple biopsies are evident. Perhaps further advance in treatment, other than improved radiation or surgery, will come from proper management of the urological complications and from a study of the microscopic response of the tumor to radiation. Of 70 patients 23, or nearly one-third, died with serious urological complications. Two patients with such complications survived after proper treatment. Anticipatory treatment of such conditions and their prevention may at once increase the number of cures. The pathological study may throw light upon the advisability of surgery in certain patients. For instance, those that do not show adequate response to radiation microscopically should be operated upon if operable, for the study shows that lack of response means lack of cure. Thus a reasonable method of selection of surgical cases is available. A study of the various charts indicates that five year percentages can be predicted from three year follow-up studies. The importance of this lies in the fact that intelligent changes in treatment can be made if three year responses are not satisfactory. It is the feeling of the Pondville Hospital group that better results will be obtained when more adequate treatment is used, more attention paid to urological complications, and when surgery is used in operable tumors that do not respond to radiation. Just as it is evident that the adenoacanthoma or adenosquamous cell cancer of the uterus is radiation resistant, so certain squamous cell carcinomas will be found to be so and will be treated by radical surgery.

It is hoped that these three papers will stimulate other investigators to carry out more intensive studies of different malignant lesions in the hope that other important lessons may be learned. JOE VINCENT MEIGS.

CANCER CONTROL IN THE RURAL SECTIONS

THE education of the American layman in the early recognition of cancer is an important phase of the warfare against this dread disease. As yet only a small proportion of our people has been reached. The cities furnish the exception where, because of proximity to hospitals and clinics, propaganda against malignant disease through the widespread dissemination of information has proved more feasible than in the rural sections. The city dweller has become cancer-conscious[1]. Educating his country cousin has been a more difficult problem as comparison of the cancer statistics of medical centers serving the rural, with those of city areas clearly shows.

Approximately 56 per cent of our total population is urban while 43.8 per cent is rural. Although it is a fact that patients living in the

[1]More than 137,000 pamphlets were distributed in 1938 by the New York City Committee of the American Society for Control of Cancer; 196 lectures given; 11 radio talks made; exhibits displayed 572 days.

more densely populated sections are being cancer educated, yet nearly half of our population remains grossly ignorant concerning this important subject. The rural patient always has a tendency to resort to home remedies and bizarre forms of self-medication, a situation for which the rural physician is frequently responsible. The habit of procrastination, so characteristic of the rural patient, is well illustrated by the following statement. In a series of two hundred sixty-seven cases of cancer of the breast admitted to the Geisinger Memorial Hospital, a center serving a far-flung rural area, it was found that the average time between the discovery of a mass in the breast and the patient's admission to the hospital was thirteen months. In a series of three hundred twenty cases of carcinoma of the colon the duration of symptoms before treatment was begun was eleven months. That when first discovered neoplastic disease is more advanced with country than with city patients is further illustrated by the following comparison of the symptoms of 200 patients with cancer of the stomach studied in a well known Boston clinic with those of 200 cancer of the stomach patients admitted to the Geisinger Memorial Hospital.

	City clinic per cent	Country clinic per cent
Anorexia	40	57
Pain	30	89
Loss of weight	25	70
Vomiting	28	62
Weakness	13	54
Hemorrhage	4	24
Palpable tumor	?	56.8
Average weight loss	25.7 lbs.	32 lbs.

Compare two American families—one rural, the other urban. The Joneses live on a farm in the foothills of the Alleghenies; the Smiths live in a tenement in New York City. In both cases the adults are approximately sixty years of age. The wives of these families begin to bleed from the vagina about ten years after the menopause. Although Mrs. Jones is aware of something unusual, she attaches no particular significance to it. Four or five months later, she consults her family physician —a busy country practitioner—who prescribes ergot, but who makes no pelvic examination. He does not see her again for six months. In the interim, in addition to the prescribed treatment, she tries a dozen or more home medicines recommended by relatives and friends and resorts to a multitude of bucolic, therapeutic vagaries practised in her neighborhood. (In certain sections of Pennsylvania she probably would have the trouble "pow-wowed.") Finally if she is examined by a competent physician, the lesion is recognized, but only after the disease has become so advanced as to make treatment useless. Over forty per cent of the women of the United States are "Mrs. Joneses" living in rural sections with no more provision for adequate care than the patient cited. In fact, 17,000,000 of our people live where there are no nearby hospitals. On the other hand, Mrs. Smith of New York, sensing that all is not well, goes around the corner to the dispensary or to the nearest free clinic, where she has been in the habit of going for consultation and where she knows she will be promptly examined and efficiently treated. Her condition is diagnosed, a biopsy is made, and a panhysterectomy is performed. There are, of course, many variations of these cases; each, however, is representative of the respective groups.

Perhaps Mr. Jones, instead of his wife, is the patient. He is under weight, suffers with "indigestion," passes blood from the rectum, and has diarrhea. After suffering several months, he consults a "pile" specialist who gives him an ointment. Later his "hemorrhoids" are injected. In all probability he

does not have a digital examination—much less one with a proctoscope. After what seems an interminable period, thoroughly desperate, he visits a medical center where his trouble is diagnosed as an inoperable carcinoma of the rectum. On the contrary, urban Mr. Smith with similar symptoms, promptly goes up the street a few blocks to a dispensary where he is informed that he is suffering from the effects of a growth in his bowel. Operated upon, he is relieved—possibly cured. Cases could be multiplied indefinitely, involving not only carcinoma but every ailment of a chronic nature, requiring expert investigation and accurate diagnosis—heart disease, tuberculosis, diabetes, etc.

During the 1936–1937 period the average expenditure on Works Progress Administration projects in Pennsylvania amounted to over $20,000,000 *every thirty days*. Not a penny of this vast amount was used for medical—much less for cancer, education. One wonders what one month's W. P. A. quota for Pennsylvania alone, applied to rural cancer education throughout the United States might have accomplished in the prevention of unnecessary deaths from neglected and unrecognized neoplastic disease.

The Public Health Bill, recently introduced by Senator Wagner, calls for an increase of $90,000,000 over and above the $100,000,000 annually spent on public health by the Federal Government. If public tax funds are to be so used—funds which, at the end of ten years, it is estimated will amount to $850,000,000 annually, there could be no more worthy expenditure of some of this money than in the advancement of cancer education among the laity—especially in the rural sections of our country. Whatever the fate of the Wagner Act, with its obvious defects, we are still faced by this enormously important public health problem. It might be added that such a tremendous task can be accomplished only through the expenditure of vast sums of money the only discernible source, apparently, being from the public funds. Without such adequate aid, only the surface can be scratched.

Working in an institution drawing patients from an extensive rural section, it is obvious that so far as cancer education is concerned in the country sections, but little progress is being made irrespective of the meritorious efforts of the American Society for the Control of Cancer and other agencies in the larger centers. It is true that more cancer clinics are needed but there is now probably, with certain exceptions, a sufficient number of well organized hospitals to handle the rural population, if patients only realized the danger and sought early aid. The question of prompt diagnosis is, therefore, largely a matter of lay education; and under these circumstances lay education means large expenditures and probably out of tax funds. This is not socialized medicine, whether we like it or not. The situation in the rural sections is not being relieved, as evidenced by the fact that the rural cancer patient is about as dilatory now as he was twenty years ago. But little more will be accomplished in the matter of decreasing cancer mortality until the people of our rural United States, people constituting nearly one-half of our entire population, can have the opportunity of receiving systematic instruction regarding this greatest of all plagues, instruction given under the direction of competent physicians and nurses in the rural schools and churches with readily accessible facilities for prompt examination and treatment when the individual's symptoms suggest the need of it. Such a plan should be under the control and direction of a central agency. It calls for an annual expenditure of many millions of dollars. What is to be the source of these funds? HAROLD L. FOSS.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THE book, entitled *Craniocerebral Injuries; Their Diagnosis and Treatment*[1], represents the crystallization of ideas conceived by the author in the observation of a large series of craniocerebral injuries at the Boston City Hospital. As a neurological surgeon, with an apparently more than usual opportunity to study traumatic brain lesions, Dr. Munro should be qualified thus to express what are now generally accepted concepts in the rational treatment of craniocerebral injuries. Most of his material is not new to other neurological surgeons; some of his ideas are distinctly original and new to both neurological and general surgeons; but in any event, most of the advice in the book can be heeded to advantage by the general surgeon into whose hands the vast majority of head injuries first come.

Munro has rightfully emphasized the value of an accurate history of the accident and the presence or absence of unconsciousness; he deplores the use of morphine at any time in the treatment of such cases; and he emphasizes the need of rest and treatment of primary shock rather than the hysterical attempts to "do something" for the patient, such as attempting to discover immediately, by x-ray, whether a skull fracture be present. In view of his own statistics he finds that lumbar puncture, judiciously but freely used, is an invaluable, even lifesaving, measure in the treatment of the increased intracranial pressure following craniocerebral damage. His statistics show, contrary to the experience of some other surgeons, that this procedure is safe and useful both for diagnostic and therapeutic purposes. The chapter on first aid in craniocerebral injuries is brief but it contains information which should be in the hands of every interne and member of an emergency room staff.

Not every neurophysiologist will agree with the author on some of his statements regarding fundamental cerebral physiopathology; not every neurological surgeon will agree with him entirely in his operative treatment of hematomas. His general principles of both conservative and operative treatment as well as his treatment of complications may be regarded as sound, and he also admits the necessity of variation according to one's own experience and wishes. Craniocerebral injuries are neurological problems, or potentially so, and they should be treated, if possible, by neurological surgeons or at least by those with an appreciation of the nervous system. Munro has failed sufficiently to emphasize this point, for he has presented his material as if he were discussing a general surgical problem for the consideration mainly of the general surgeon.

The book is easily read, for the author's style is simple and straightforward. However, the last chapter, comprised of a large series of illustrative case histories relative to mortality and morbidity statistics, is disproportionately long. JOHN MARTIN.

THE second edition of *Clinical Laboratory Methods and Diagnosis*[2] has appeared within the brief space of 3 years. The revision has been unusually complete. It has been lengthened from 1,028 pages to 1,607 pages, and numerous new figures and color plates have been added. Obsolete and impractical tests have been replaced by the more important new tests that have been described in the past 3 years. Representative of such material are the tests for vitamin C and sulfanilamide in the blood and the Neufeld method of typing pneumococcus. It is regrettable that the Quick prothrombin time and the Ivy bleeding time, which show promise of being very useful diagnostic tests, have been omitted. New features of the edition are the revision of the chapter on parasitology and tropical medicine with the assistance of Professor Pedro Kourí, and the addition of a new chapter on the detection of crime by laboratory methods.

The general nature of this volume is similar to the first edition. About half the book is devoted to tests frequently performed in the physician's office laboratory, whereas the other half is devoted to bacteriology, serology, parasitology, postmortem technique, tissue technique, toxicology, and methods of crime detection. Procedures have been outlined in considerable detail and the clinical interpretations are simple and direct. The author has drawn freely from recent literature on laboratory diagnosis. Reference to this material is given at the bottom of the page on which it appears. Three hundred pages are given to the section on hematology. The theories of Schilling with their clinical application and interpretations are described in detail. Schematic charts are used to illustrate the various theories of blood formation. Many of the colored plates of individual cells are small and lack detailed morphological characteristics. However, the composite plates of blood smears in various diseases are very realistic and should prove very useful to the clinician. Considerable attention is given to bone marrow studies.

This book, which is almost encyclopedic in its scope, contains a variety of material rarely found in

[1] CRANIOCEREBRAL INJURIES; THEIR DIAGNOSIS AND TREATMENT. By Donald Munro, A.B., M.D., F.A.C.S. London, New York, Toronto: Oxford University Press, 1938.

[2] CLINICAL LABORATORY METHODS AND DIAGNOSIS; A TEXTBOOK ON LABORATORY PROCEDURES WITH THEIR INTERPRETATION. By R. B. H. Gradwohl, M.D. 2d ed. St. Louis: The C. V. Mosby Co., 1938.

a single volume on laboratory methods and diagnosis. It is well bound and is printed on a fine grade of paper. Because of its length and size it is not well adapted for routine use in teaching medical students. As a guide and reference book for the physician and laboratory worker, this excellent work can be highly recommended. HOWARD L. ALT.

IN a 500 page volume without illustrations, Sir Comyns Berkeley, Victor Bonney, and Douglas MacLeod offer *The Abnormal in Obstetrics*.[1] This treatise begins with sterility, and an attempt is made to include any and all pathological conditions one may encounter in the field of obstetrics, i.e., it covers medicine, surgery, dermatology, pediatrics, etc. Necessarily, a mere mention of many of these subjects is all that is presented and, therefore, one wonders why they are included at all.

If such a work were divided into sections, one of which dealt strictly with pathological obstetrics *per se*, another with medical complications, and one with surgical complications, etc., it would simplify the reading. It is the reviewer's opinion that this work attempts to embrace too much in one volume. It is an interesting observation that in the chapter on analgesics, 3 pages are donated to "twilight sleep" and 3 lines to the barbiturates. A complete bibliography is contained at the end of the volume. CHESTER C. DOHERTY.

EVENTS in certain phases of otological surgery have moved rapidly during the past 5 years and the editor of *Surgery of the Ear*,[2] Kopetzky, has kept abreast of the times and correlated all the latest works from the various medical centers and placed them in an easily readable and comprehensive volume, well illustrated and complete to date.

During the past 5 years many surgical advances have been made both in treating suppurative diseases and surgical advances in the amelioration and prevention of deafness. Recognition of suppuration of the petrous tip and its surgical attack has reached a stage of standardization. Gunnar Holmgren's operative procedure for deafness in otosclerosis has gained world-wide recognition, and Lempert's latest work on the endaural approach to the mastoid bone and petrosa are now being accepted generally by otologists. These are a few of the latest advances written in monographic style by men experienced in that particular phase of otological surgery.

Over 400 pages comprise the text which is on good paper and profusely illustrated. There are 17 contributors, and the book can best be described and recommended as being up to date for all phases of otological surgery. JOHN F. DELPH.

[1] THE ABNORMAL IN OBSTETRICS. By Sir Comyns Berkeley, M.A., M.C., M.D. (Cantab.), F.R.C.P. (Lond.), F.R.C.S. (Eng.), M.M.S.A. (Hon.), F.C.O.G., Victor Bonney, M.S., M.D., B.Sc. (Lond.), F.R.C.S. (Eng.), F.R.A.C.S. (Hon.), M.R.C.P. (Lond.), and Douglas MacLeod, M.S., M.B. (Lond.), F.R.C.S. (Eng.), F.R.C.P. (Lond.), M.C.O.G. Baltimore: William Wood & Co., 1938.

[2] SURGERY OF THE EAR. Edited by Samuel J. Kopetzky, M.D., F.A.C.S. New York and Edinburgh: Thomas Nelson & Sons, 1938.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

A TEXTBOOK OF BACTERIOLOGY; THE APPLICATION OF BACTERIOLOGY AND IMMUNOLOGY TO THE ETIOLOGY, DIAGNOSIS, SPECIFIC THERAPY AND PREVENTION OF INFECTIOUS DISEASES FOR STUDENTS AND PRACTITIONERS OF MEDICINE AND PUBLIC HEALTH. By Hans Zinsser, M.D., and Stanhope Bayne-Jones, M.D. 8th rev. ed. New York and London: D. Appleton-Century Co. Inc., 1939.

LES MOIGNONS DOULOUREUX. By Frédéric P. Leclerc and Pierre Moreau. Paris: Louis Arnette, 1939.

ROENTGEN TECHNIQUE. By Clyde McNeill, M.D. Springfield, Ill., and Baltimore, Md.: Charles C. Thomas, 1939.

DIAGNOSIS AND MANAGEMENT OF DISEASES OF THE BILIARY TRACT. By R. Franklin Carter, B.S., M.D., F.A.C.S., Carl H. Greene, A.B., Ph.D., M.D., F.A.C.P., and John Russell Twiss, A.B., M.D., F.A.C.P. Philadelphia: Lea & Febiger, 1939.

ARCHITECTURE OF THE KIDNEY IN CHRONIC BRIGHT'S DISEASE. By Jean Oliver. New York and London: Paul B. Hoeber, Inc., 1939.

OXFORD MEDICAL PUBLICATIONS. PULMONARY TUBERCULOSIS; PATHOLOGY, DIAGNOSIS MANAGEMENT AND PREVENTION. By George Gregory Kayne, M.D., M.R.C.P., D.P.H., Walter Pagel, M.D., and Laurence O'Shaughnessy, M.D., F.R.C.S. London, New York, and Toronto: Oxford University Press, 1939.

OXFORD MEDICAL PUBLICATIONS. URINE EXAMINATION AND CLINICAL INTERPRETATION. By C. E. Dukes, M.Sc. (London), M.D. (Edin.), D.P.H. (London). London, New York, and Toronto: Oxford University Press, 1939.

OXFORD MEDICAL PUBLICATIONS. THE HEART-SOUNDS IN NORMAL AND PATHOLOGICAL CONDITIONS. By Oscar Orías, M.D., and EDUARDO BRAUN-MENÉNDEZ, M.D. London, New York, and Toronto: Oxford University Press, 1939.

TREATMENT BY MANIPULATION. By A. G. Timbrell Fisher, M.C., M.B., Ch.B., F.R.C.S. (Eng.). New York: Paul B. Hoeber, Inc., 1939.

TRANSACTIONS OF THE THIRD INTERNATIONAL GOITER CONFERENCE AND THE AMERICAN ASSOCIATION FOR THE STUDY OF GOITER. Portland, Oregon: The Western Journal of Surgery, Obstetrics and Gynecology, 1939.

PROCTOLOGY FOR THE GENERAL PRACTITIONER. By Frederick C. Smith, M.D., M.Sc. (Med.), F.A.P.S. Philadelphia: F. A. Davis Co., 1939.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

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PRELIMINARY PROGRAM FOR 1939 CLINICAL CONGRESS

THE twenty-ninth annual Clinical Congress of the American College of Surgeons will meet in Philadelphia during the five days, October 16–20, and the surgeons of that great medical center are planning a most complete program of operative clinics and demonstrations which will be held in local hospitals. A return to Philadelphia for such a meeting is always a welcome announcement to those who plan to attend because of the exceptional quality of the programs which are always developed by these outstanding leaders in medicine and surgery. Headed by strong and representative committees, the clinicians at the five medical schools and more than forty participating hospitals have arranged programs which will demonstrate to their guests the latest advances in surgical technique and operative procedures. A schedule of the operative clinics, demonstrations, exhibits, and other presentations to be given at the hospitals and medical schools appears in the following pages. These will be finally revised and amplified immediately preceding the Congress. Clinics will be held in the hospitals in the afternoon of Monday, October 16, and the mornings and afternoons of each of the following four days.

In addition to the extensive and well-arranged schedule of operative clinics at which the technique of a wide variety of surgical procedures will be demonstrated in the operating rooms, the committees have arranged a series of nonoperative clinics and symposia in many of the large hospitals for the presentation of important work being done in special fields. In many instances the local surgeons have invited prominent guests from other medical centers to participate in these discussions. There will be demonstrations and exhibits covering general surgery, genito-urinary surgery, neurosurgery, fractures and other traumas, obstetrics and gynecology, broncho-esophagology, plastic and faciomaxillary surgery, surgery of the bones and joints, thoracic surgery, ophthalmology, and oto-rhinolaryngology. All of these programs are being correlated in order that the visiting surgeon may be assured of the opportunity to devote his time continuously, if he so desires, to clinics dealing with the special subject in which he may be most interested, i.e., there will be adequate morning and afternoon programs dealing with general surgery and each specialty for each day of the entire Congress. The final program will be published and classified according to the various specialties to aid the visiting surgeon in the selection of the clinics which he desires to attend. A complete detailed program will be posted each afternoon for the succeeding day in the form of Bulletins in accessible places among the technical exhibits at the headquarters hotel. They will be published in printed form for distribution each morning.

The annual meeting of the governors and fellows of the College will be held in the Rose Garden of Bellevue-Stratford Hotel on Thursday afternoon at 1:30 o'clock. Reports on activities of the College will be presented by the officers and chairmen of the standing committees, followed by the election of officers.

The attention of fellows is called to the meetings of three important state and provincial committees to be held on Wednesday in the Palm Garden, on the first floor of the hotel, as follows: Judiciary committees, 9:30 a.m.; Credentials committees, 10 a.m.; Executive committees, 11 a.m. Also of importance is a meeting of the national and regional committees on fractures on Thursday afternoon at 4 o'clock in the South Garden.

The showing of surgical motion picture films, which so faithfully depict clinical features of major interest to surgeons, will be continued at

CLINICAL CONGRESS PROGRAM IN BRIEF

All sessions at the Bellevue-Stratford except as noted.

Monday, October 16

10:00 Hospital Conference—Rose Garden.
11:00 Assembly of Initiates—Palm Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Hospital Conference—Rose Garden.
2:00 Surgical Film Exhibition—Palm Garden.
8:00 Presidential Meeting and Convocation—Academy of Music.

Tuesday, October 17

9:00 Clinics in Philadelphia Hospitals.
9:30 Hospital Conference—Rose Garden.
10:00 Clinical Demonstrations, Ophthalmology—North Garden.
10:00 Clinical Demonstrations, Otorhinolaryngology—South Garden.
10:00 Surgical Film Exhibition—Palm Garden.
12:30 Midday Panel Discussions—North Garden, South Garden, Rose Garden, Palm Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Hospital Conferences—Rose Garden, South Garden.
2:00 Symposium on Fractures and Other Traumas—Witherspoon Hall.
2:00 Surgical Film Exhibition—Palm Garden.
8:00 Scientific Session, General Surgery—Irvine Hall.
8:00 Scientific Session, Ophthalmology—North Garden.
8:00 Scientific Session, Otorhinolaryngology—South Garden.
8:00 Hospital Conference—St. Joseph's Hospital.

Wednesday, October 18

9:00 Clinics in Philadelphia Hospitals.
9:30 Hospital Conference—Rose Garden.
9:30 State and Provincial Judiciary Committees—Palm Garden.
10:00 State and Provincial Credentials Committees—Palm Garden.
11:00 State and Provincial Executive Committees—Palm Garden.
10:00 Clinical Demonstrations, Ophthalmology—North Garden.
10:00 Clinical Demonstrations, Otorhinolaryngology—South Garden.
12:30 Midday Panel Discussions—North Garden, South Garden, Rose Garden, Palm Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Hospital Demonstrations—Philadelphia Hospitals.
2:00 Symposium on Cancer—Rose Garden.
2:00 Surgical Film Exhibition—Palm Garden.
7:30 Surgical Film Exhibition (ophthalmology and otorhinolaryngology)—Palm Garden.
8:00 Scientific Session, General Surgery—Irvine Hall.

Thursday, October 19

9:00 Clinics in Philadelphia Hospitals.
9:30 Hospital Conference—Rose Garden.
10:00 Clinical Demonstrations, Ophthalmology—North Garden.
10:00 Clinical Demonstrations, Otorhinolaryngology—South Garden.
10:00 Surgical Film Exhibition—Palm Garden.
12:00 Midday Panel Discussions—North Garden, South Garden, Palm Garden.
1:30 Annual Meeting—Rose Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Hospital Demonstrations—Philadelphia Hospitals.
3:00 Symposium on Graduate Training—Rose Garden.
3:30 Surgical Film Exhibition—Palm Garden.
4:00 National and Regional Fracture Committees—South Garden.
8:00 Scientific Session, General Surgery—Irvine Hall.
8:00 Scientific Session, Ophthalmology—North Garden.
8:00 Scientific Session, Otorhinolaryngology—Rose Garden.

Friday, October 20

9:00 Clinics in Philadelphia Hospitals.
10:00 Clinical Demonstrations, Ophthalmology—North Garden.
10:00 Clinical Demonstrations, Otorhinolaryngology—South Garden.
10:00 Surgical Film Exhibition—Palm Garden.
12:30 Midday Panel Discussions—North Garden, South Garden, Rose Garden, Palm Garden.
2:00 Symposium on Obstetrics and Gynecology—North Garden.
2:00 Symposium on Urology—South Garden.
2:00 Symposium on Thoracic Surgery—Rose Garden.
2:00 Clinics in Philadelphia Hospitals.
2:00 Surgical Film Exhibition—Palm Garden.
8:00 Meeting on Health Conservation—Irvine Hall.

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this year's Congress. A wide variety of special subjects will be covered in this program dealing with newer methods in technique and procedures. Of special interest to the ophthalmologists and otorhinolaryngologists will be the extensive showing of films dealing with subjects related to these specialties. These sound and silent films will be presented according to schedules announced in the daily Bulletins in the Palm Garden of the headquarters hotel.

SCIENTIFIC SESSIONS

General scientific sessions will be held on Tuesday, Wednesday, and Thursday evenings in Irvine Hall at the University of Pennsylvania, the detailed programs of which will be found in the following pages. In planning these programs the Committee has aimed at a selection of material which will make it possible for all the general surgeons and surgical specialists attending the Congress to learn of the newer developments in their respective fields. A feature of the program for Wednesday evening is the annual fracture oration to be delivered by Dr. Fraser B. Gurd, of Montreal, the subject being the "Ambulatory Treatment of Fractures of the Lower Extremities."

Beginning on Tuesday afternoon and continuing on the three following afternoons, symposia will be presented dealing with subjects of broad interest. On Tuesday afternoon the symposium will deal with fractures and other traumas, includ-

ing discussions of standard operations for hip reconstruction; chest injuries; use of hanging casts for fractures of the shaft of the humerus; traction treatment for fractures of the os calcis; use of sulfanilamide in gas gangrene. These subjects will be discussed by speakers who have had broad experience in the treatment of these conditions. The symposium on Wednesday afternoon will deal with the cancer problem, and on Thursday afternoon the College program for graduate training for general surgery and the surgical specialties. Three symposia will be held simultaneously on Friday afternoon, dealing with diseases of the respiratory tract, urological surgery, and obstetrics and gynecology.

The midday panel discussions, introduced last year, proved so popular that at this year's Congress they have been extended to include fifteen sessions, four to be held simultaneously on Tuesday, Wednesday, and Friday, and three on Thursday. Meeting places will be the North Garden, South Garden, Palm Garden, and Rose Garden at the Bellevue-Stratford. In addition to surgical subjects, topics related to surgery, such as diet, drugs, anesthesia, infections, operating room technique, and the preservation of blood for transfusions will be discussed. At each of these meetings, which will necessarily be restricted by time to narrower phases of the subjects than would be covered in regular sessions, a carefully selected leader will present a 10 minute outline, to be followed by discussion from different viewpoints by two or more collaborators, and then by general question and comment from the audience.

In the following pages are presented also programs for a series of four scientific sessions on Tuesday and Thursday evenings for the sections on ophthalmology and otorhinolaryngology. Supplementing the clinical programs in these specialties, prepared by the local Committee, the programs for these sessions present an exceptional variety of interesting and helpful features and discussions. Of special interest is the program for Thursday evening dealing with various phases of broncho-esophagology, presented as a tribute to Dr. Chevalier Jackson for his outstanding work in this special field.

PRESIDENTIAL MEETING AND CONVOCATION

The combined presidential meeting and convocation will be held in the Academy of Music on Monday evening, opening with a processional of the officers, regents, and honorary guests. Dr. Thomas A. Shallow, chairman of the Committee on Arrangements, will welcome the assembly, and Dr. Vernon C. David, vice-president of the College, will introduce the foreign guests. Dr. Howard C. Naffziger, the retiring president, will deliver the presidential address, after which the incoming officers will be inaugurated, the initiates presented for fellowship, fellowships and honorary fellowships will be conferred, and the medical records prize awarded. Dr. Evarts A. Graham will deliver the annual oration on surgery, his subject being "Intrathoracic Tumors."

ASSEMBLY OF INITIATES

The 1939 initiates will attend an assembly on Monday morning at 11:00 o'clock in the Palm Garden of the hotel. Dr. Howard C. Naffziger, president of the College, will open the meeting with appropriate remarks. Dr. Irvin Abell, vice-chairman of the Board of Regents, and Dr. Bowman C. Crowell and Dr. Malcolm T. MacEachern, associate directors of the College, will briefly outline the program of the American College of Surgeons. After the initiates have recited the fellowship pledge, they will be formally greeted by Dr. George P. Muller, president-elect, and will sign the fellowship roll after closing remarks by Dr. George Crile, chairman of the Board of Regents.

OPHTHALMOLOGY AND OTORHINOLARYNGOLOGY

Special attention has been given through subcommittees to the development of an extensive program for the ophthalmologists and otorhinolaryngologists. Featured in the mornings will be the special clinical demonstrations to be held at the headquarters hotel on Tuesday, Wednesday, Thursday, and Friday. These sessions, held separately for each group, will cover many of the problems of current interest to those who work in these special fields. Operative clinics and demonstrations are scheduled to be held each afternoon in the hospitals.

CLINICAL DEMONSTRATIONS—OTORHINOLARYNGOLOGY

Tuesday, 10:00 a.m.

WILLIAM HEWSON. Operative Indications in Sinusitis.
CARL M. HOUSER. Topic to be announced.
HENRY A. MILLER. Treatment of Sinusitis in Children.
THOMAS F. GOWEN. Management of Nasopharyngeal Fibromata.

Wednesday, 10:00 a.m.

ROBERT H. IVY. Pathological Conditions of the Mouth.
GABRIEL TUCKER. Diagnosis and Treatment of Laryngeal Tumors Benign and Malignant (color motion picture).
CHEVALIER L. JACKSON. Bronchoscopic Aspects of Bronchial and Pulmonary Tumors.
LOUIS CLERF. Pathological Conditions of the Esophagus.

Thursday, 10:00 a.m.

Symposium on Chronic Progressive Deafness.
OSCAR V. BATSON. Anatomy and Physiology of the Ear.

HARRY P. SCHENCK. Thyroxin in the Treatment of Deafness and Tinnitus.
WALTER HUGHSON. Surgical Treatment (round window grafts).
EDWARD H. CAMPBELL. Surgical Treatment (labyrinth fistulization).

Friday, 10:00 a.m.

F. HAROLD KRAUSS. Diagnosis of Lateral Sinus Thrombosis (report of cases).
HOWARD M. HEBBLE. Treatment of Otitis Media and Mastoiditis of Infants and Children with Sulfanilamide.
HARRISON F. FLIPPIN. Treatment of Pneumococcus Meningitis with Sulfapyridine.

OPHTHALMOLOGY

Tuesday, 10:00 a.m.

F. H. ADLER. Dark Adaptation.

Wednesday, 10:00 a.m.

W. I. LILLIE. Fundus Changes Associated with Neurosurgical Conditions.

Thursday, 10.00 a.m.

E. B. SPAETH. Subject to be announced.

Friday, 10:00 a.m.

I. S. TASSMAN. The Conduct and Methods of a Refraction Department in a Large Hospital.

GRADUATE TRAINING FOR SURGERY

Following the annual meeting of the fellows on Thursday afternoon, there will be a conference on Graduate Training for Surgery at 3:00 p.m., which promises to be of major interest to everyone attending the Clinical Congress. Raising the standards of surgery has been the primary purpose of the American College of Surgeons since its organization, and the direct action which has now been taken in sponsoring the present program of guidance and service for approved hospitals desirous of developing or improving their facilities for graduate training in surgery has stimulated wide interest in this subject.

The committee charged with the development of this program authorized the field staff of the College to begin personal surveys of hospitals and study of their problems in January, 1937. Interested institutions throughout the United States and Canada have been visited during the past three years and the list of hospitals approved for graduate training in surgery and the surgical specialties has been published in the 1939 BULLETINS of the College, together with outlines of the plans and educational programs of a representative group of hospitals.

A vast amount of information and data have been assembled at the College which will form the basis for the report of the Committee on Graduate Training for Surgery, to be presented by its chairman, Dr. Dallas B. Phemister, of Chicago, at this session.

Leaders in the field of graduate medical education will present and discuss at length the various problems to be met in a hospital desiring to train young surgeons according to the present concept of required qualifications for fellowship in the College. The discussion will deal with all phases of organization and supervision of the educational programs, basic science requirements, records, reports, and examinations necessary in the proper evaluation of graduate training in hospitals and other institutions. This session should be of great importance to the entire fellowship of the College as many practical suggestions will be offered which will be of great value to those charged with the responsibility of developing in hospitals the needed systematic supervision, preceptorship, and guided instruction so essential in the training of surgeons.

HOSPITAL CONFERENCE

The twenty-second annual Hospital Standardization Conference during the Clinical Congress in Philadelphia, October 16 to 20, inclusive, will provide an opportunity for the thorough discussion of many problems incident to the institutional care of the patient which are of vital interest to members of medical staffs of hospitals, trustees, administrators, and other executive personnel. During the four day conference carefully selected speakers from various fields of hospital work will participate in the program. Addresses, panel discussions, round table conferences, and practical demonstrations will characterize this conference and all the participants will present well selected and prepared subject matter.

The conference will open at 10:00 a.m. on Monday, October 16, in the Rose Garden of the Bellevue-Stratford Hotel. Following an address by Dr. Howard C. Naffziger, San Francisco, president of the College, Dr. George Crile, Cleveland, chairman of the Board of Regents of the College, will officially present the list of approved hospitals for 1939. Five discussions of major interest will then follow—two on graduate training for general surgery and the surgical specialties and three by presidents of national hospital organizations on (1) voluntary hospitals and their preservation, (2) essential qualifications of a competent hospital administrator, and (3) the need for educated and trained personnel in caring for the sick. The discussion of these subjects will be opened by Dr. George P. Muller, Philadelphia, president-elect of the College.

At two other sessions—on Monday afternoon and on Thursday morning—a variety of important topics will be discussed. The Monday after-

noon session will include opening remarks on hospital standardization in Canada by Dr. Fraser B. Gurd, vice-president of the College, followed by discussions on (1) the relation of nursing hours to various types of diseases; (2) the relation of diet therapy and more particularly vitamins, to the surgical patient; (3) the responsibility of the hospital trustee; (4) research and statistics as applicable to hospitals; and (5) nursing service in relation to administrative activities of the hospital. The Thursday morning session will be equally interesting and include discussion of radio interference caused by electromedical and surgical equipment; organization and operation of a tumor unit; and three talks on principles of relationship between hospitals and radiologists, pathologists, and anesthetists, respectively. Both sessions will be held in the Rose Garden.

Tuesday morning's session will be given over to a discussion on "The Medical Staff; Its Organization and Function," commencing at 10:00 a.m. in the Rose Garden. Following the presentation of the subject "The Importance of an Efficient Medical Staff to a Hospital," four speakers will discuss the general theme of the session from the standpoints of what actually constitutes a medical staff; proper procedures in extending hospital privileges; and making appointments to the medical staff, selection and appointment of chief of medical staff and heads of clinical departments. The session will be concluded by a presentation and discussion on controlling the clinical work through accounting of professional services.

A panel round table conference of special interest on the general theme, "The Organization and Management of the Small Hospital," will be held on Tuesday afternoon in the South Garden. Participants in this program will discuss the general theme from the standpoints of the importance of the small hospital in certain communities, maintaining competent personnel, medical staff organization, medical records, clinical laboratory and x-ray services, nursing, and financing. Special emphasis will be laid on the importance of all small hospitals meeting the minimum requirements. At the same time in the North Garden there will be held panel discussions on problems pertaining to various phases of hospital administation in the large hospital. Related topics to be discussed include administrative practices, accounting control and hospital costs, anesthesia, care of emergencies, control of postoperative infections from the standpoint of surgical instruments, hospitalization and compensation charges. These topics should appeal to a variety of interests. The session will be under the direction of Dr. Wilmar M. Allen, Hartford, Conn., superintendent of the Hartford Hospital.

On Tuesday evening the auditorium of St. Joseph's Hospital will accommodate the large audience which is expected to attend a round table conference at which pertinent problems, submitted by hospital executives, will be presented and discussed under the leadership of Robert Jolly, Houston, Texas, and Dr. Malcolm T. MacEachern, Chicago. Opportunity will be given everyone present to submit their specific problems for discussion.

The joint conference of the American College of Surgeons and the American Association of Medical Record Librarians will be held in the Rose Garden, Wednesday morning under the chairmanship of Dr. Robin C. Buerki, Chicago. The session will be opened by a review of the present status of medical records in the United States and Canada by Dr. E. W. Williamson, assistant director of the American College of Surgeons. Following this, the president of the Association, Lillian H. Erickson, Chicago, will discuss "The Present Status of the Training of Medical Record Librarians." Other subjects on this program will include "Overcoming Difficulties in Obtaining Good Medical Records in a Small Hospital," "The Place of the Medical Secretary in the Hospital," "Systematic Procedure Necessary in Keeping Current Medical Records Up to Date," and "How to Secure Specialty Medical Records." These presentations will be followed by a round table conference on "Medical Record Problems," to be conducted by Dr. W. F. Wood, Waverly, Mass.

A unique feature of the four day program will be the demonstrations in local hospitals on Wednesday and Thursday afternoons. These will include a wide variety of administrative and technical procedures which will be of utmost interest and practical value to general and specialized hospital personnel. The demonstrations will include many new and interesting features now of proved value.

Ample opportunity for informal discussion will be given at all of the sessions of the conference. Exhibits and motion pictures of interest to hospital people will provide additional educational possibilities. Governing boards of hospitals will find their institutions well repaid in added incentive and knowledge by permitting members of their medical staffs and administrative organization to take advantage of the discussions at this conference. A most cordial invitation is extended to every hospital to be represented at this hospital conference.

ADVANCE REGISTRATION

The hospitals and medical schools of the Philadelphia area afford accommodations for large numbers of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be limited to the number that can be comfortably accommodated at the clinics. The limit of attendance will be based upon the results of a survey of the operating rooms and laboratories of the hospitals and medical schools to determine their capacity for visitors. It is expected, therefore, that those surgeons who wish to attend the Congress will register in advance. A registration fee will be required in order to provide funds with which to meet the expenses of the Congress. A formal receipt will be issued to each surgeon registering in advance which is to be exchanged for a general admission card upon his registration at headquarters during the Congress. This card, which is not transferable, must be presented to secure clinic tickets and admission to scientific sessions.

A resolution adopted by the Board of Regents provides that the registration fee for fellows and endorsed junior candidates shall be $5.00; that no fee for the 1939 Congress shall be required of initiates (class of 1939); that the fee for non-fellows attending as invited guests of the College will be $10.00.

As in previous years, admission to clinics and demonstrations at the hospitals will be controlled by means of clinic tickets, which plan provides an efficient means for the distribution of visiting surgeons at the various clinics and assures against overcrowding. The number of tickets issued for any clinic will be limited to the capacity of the room in which the presentation is held.

HEADQUARTERS—TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Bellevue-Stratford Hotel where there are unusual facilities for accommodating the Congress. The Ballroom, Palm Garden, Clover and Red rooms and other large rooms on the first and second floors and the roof have been reserved for scientific exhibits and conferences, registration, clinic ticket bureaus, bulletin boards, executive offices, etc. Thus, the activities of the Congress will be centralized under one roof.

The Technical Exhibition will be located in the Ballroom and adjacent rooms on the second floor. The registration and clinic ticket bureaus, together with the registration desk, will be centrally located on that floor. The bulletin boards, on which the daily clinical programs will be posted each afternoon, will be distributed through the exhibit rooms. Leading manufacturers of surgical instruments and supplies, x-ray equipment, operating room lights, hospital apparatus of all kinds, ligatures, dressings, pharmaceuticals, and publishers of medical books will be represented.

COMMITTEE ON ARRANGEMENTS

EXECUTIVE COMMITTEE

Thomas A. Shallow, Chairman
Lewis K. Ferguson, Secretary
William Bates
W. E. Burnett
Edward L. Campbell
J. Montgomery Deaver
Everett H. Dickinson
Gilson C. Engel
Theodore R. Fetter
Kenneth E. Fry
Ralph Goldsmith
Francis Grant
Robert H. Ivy
Chevalier L. Jackson
Richard H. Meade
Thaddeus L. Montgomery
J. T. Nicholson
John Paul North
Hubley R. Owen
Franklin L. Payne
Warren S. Reese
Frederick R. Robbins
Thomas J. Ryan
Calvin M. Smyth, Jr.
Margaret Sturgis

SUB-COMMITTEES

Broncho-Esophagology—Chevalier L. Jackson, Chairman.
General Surgery—Hubley R. Owen, Chairman.
Genito-Urinary Surgery—Theodore F. Fetter, Chairman; Alexander Randall.
Industrial Surgery—William Bates, Chairman.
Neuro-Surgery—Francis Grant, Chairman.
Obstetrics and Gynecology—Franklin L. Payne, Chairman; Norris W. Vaux, Thaddeus L. Montgomery.
Ophthalmology—Warren S. Reese, Chairman.
Orthopedic Surgery—J. T. Nicholson, Chairman.
Otorhinolaryngology—Edward L. Campbell, Chairman.
Plastic Surgery—Robert H. Ivy, Chairman.
Publicity—Kenneth E. Fry, Chairman; J. Montgomery Deaver, Richard H. Meade.
Thoracic Surgery—W. Emory Burnett, Chairman.

PHILADELPHIA HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Bellevue-Stratford, there are many first-class hotels within a short walking distance, providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date at the following hotels which are recommended by the committee:

	Minimum rate with bath	
	Single	Double
Adelphia, 13th and Chestnut Sts.	$3.85	$5.50
Barclay, Rittenhouse Square, E.	4.50	7.00
Bellevue-Stratford, Broad and Walnut Sts.	3.85	5.50
Benjamin Franklin, 9th and Chestnuts Sts.	3.85	5.50
Colonial, 11th and Spruce Sts.	2.50	3.85
Drake, 1512 Spruce St.	4.00	6.00
Majestic, Broad St. and Girard Ave.	2.50	4.00
Philadelphian, 39th and Chestnuts Sts.	2.75	4.40
Ritz Carlton, Broad and Walnut Sts.	3.50	6.00
Robert Morris, 17th and Arch Sts.	2.50	3.50
Spruce, 13th and Spruce Sts.	1.50	2.50
St. James, 13th and Walnut Sts.	2.75	4.50
Sylvania, Juniper and Locust Sts.	3.00	5.00
Walton, Broad and Locust Sts.	2.50	4.00
Warwick, 17th and Locust Sts.	4.50	7.00
Wellington, 19th and Walnut Sts.	4.00	6.00

PROGRAM FOR EVENING SESSIONS

Presidential Meeting and Convocation—Monday, 8:00 p.m.—Academy of Music

Processional—Officers, Regents, and Honorary Guests.

Invocation.

Address of Welcome. THOMAS A. SHALLOW, M.D., Philadelphia, Chairman, Committee on Arrangements.

Introduction of Foreign Guests. VERNON C. DAVID, M.D., Chicago, Vice President.

Address of Retiring President. HOWARD C. NAFFZIGER, M.D., San Francisco.

Inauguration of Officers:

President: GEORGE P. MULLER, M.D., Philadelphia

First Vice President: HENRY W. CAVE, M.D., New York

Second Vice President: D. EDWIN ROBERTSON, M.D., Toronto

Presentation of Initiates for Fellowship. GEORGE CRILE, M.D., Cleveland, Chairman, Board of Regents.

Conferring of Fellowships by the President. GEORGE P. MULLER, M.D., Philadelphia.

Conferring of Honorary Fellowships. The President.

Medical Records Prize Award.

Annual Oration on Surgery. Intrathoracic Tumors. EVARTS A. GRAHAM, M.D., St. Louis.

Tuesday, 8:00 p.m.—Irvine Hall

The Essential Principles in Clean Wound Healing. ALLEN O. WHIPPLE, M.D., New York.

Control of Hemorrhagic Tendencies, Including Physiology and Chemistry. WALTMAN WALTERS, M.D., Rochester, Minn.

Water and Salt Requirements in the Postoperative Case. FREDERICK A. COLLER, M.D., Ann Arbor, Mich.

Vitamin and Protein Factors in the Pre-operative and Postoperative Care of Surgical Patients. EMILE HOLMAN, M.D., San Francisco.

Wednesday, 8:00 p.m.—Irvine Hall

Decompression in the Treatment of Intestinal Obstruction. D. EDWIN ROBERTSON, M.D., Toronto.

Management of Chronic Pelvic Infections. GEORGE H. GARDNER, M.D., Chicago.

Conservative Surgery of Bone Tumors. DALLAS B. PHEMISTER, M.D., Chicago.

Fracture Oration: The Ambulatory Treatment of Fractures of the Lower Extremity. FRASER B. GURD, M.D., Montreal.

Thursday, 8:00 p.m.—Irvine Hall

The Re-establishment of the Gastric Passage after Resection. PROF. DR. JENO POLYA, Budapest, Hungary.

Duplications of the Alimentary Tract. WILLIAM E. LADD, M.D., Boston.

Evaluation of Current Methods in the Management of Peptic Ulcer. VERNE C. HUNT, M.D., Los Angeles

Operability and Factors which Increase Curability of Malignancy of the Colon and Rectum. THOMAS E. JONES, M.D., Cleveland.

OPHTHALMOLOGY

Tuesday, 8:00 p.m.—North Garden, Bellevue-Stratford Hotel

Symposium: Surgical Aspect of Detachment of the Retina

Results of Operations for Detachment of the Retina at the Mayo Clinic. WILLIAM L. BENEDICT, M.D., Rochester, Minn.

Results of Operations for Detachment of the Retina at the New York Eye and Ear Infirmary. CONRAD BERENS, M.D., New York.

Results of Operations for Detachment of the Retina at the Memphis Eye, Ear, Nose, and Throat Hospital. EDWARD C. ELLETT, M.D., Memphis, Tenn.

Results of Operations for Detachment of the Retina at the Illinois Eye and Ear Infirmary. SAMUEL J. MEYER, M.D., Chicago.

Results of Operations for Detachment of the Retina at the Washington University School of Medicine. LAWRENCE T. POST, M.D., and THEODORE E. SANDERS, M.D., St. Louis.

General Discussion.

Thursday, 8:00 p.m.—North Garden, Bellevue-Stratford Hotel

Recent Advances in Plastic Surgery about the Eyes (Technique). VILRAY P. BLAIR, M.D., St. Louis.
The Technique of Correction of Blepharoptosis. DANIEL B. KIRBY, M.D., New York.
General Discussion.

OTORHINOLARYNGOLOGY

Tuesday, 8:00 p.m.—South Garden, Bellevue-Stratford Hotel

Symposium: Evaluation of Methods of Treatment in Sinusitis

The Indications for Surgical Treatment in Sinusitis. FREDERICK T. HILL, M.D., Waterville, Maine.
The Treatment of Accessory Sinus Infections in Young Children. EDWARD A. LOOPER, M.D., Baltimore.
General Discussion.

Thursday, 8:00 p.m.—Rose Garden, Bellevue-Stratford Hotel

CHEVALIER JACKSON, M.D., Philadelphia, Honor Guest
GEORGE P. MULLER, M.D., Philadelphia, President, American College of Surgeons, Presiding

Introductory Remarks. GEORGE P. MULLER, M.D., Philadelphia.
Response. CHEVALIER JACKSON, M.D., Philadelphia.
Present Trends in the Technique of Laryngectomy. CHEVALIER JACKSON, M.D., Philadelphia.
Foreign Bodies in the Air and Food Passages (Observations on End Results in a Series of Nine Hundred Fifty Cases). LOUIS H. CLERF, M.D., Philadelphia.
Laryngofissure after the Technique of Chevalier Jackson (Observations on Technique and Results in a Series of Over One Hundred Cases). GABRIEL TUCKER, M.D., Philadelphia.
The Development of Broncho-esophagology. CHARLES J. IMPERATORI, M.D., New York.
The Voice after Laryngeal Operations. CHEVALIER L. JACKSON, M.D., Philadelphia.

PROGRAM FOR AFTERNOON SESSIONS

SYMPOSIUM ON FRACTURES AND OTHER TRAUMAS

Tuesday, 2:00 p.m.—Witherspoon Hall

ROBERT H. KENNEDY, M.D., New York, Chairman, Committee on Fractures and Other Traumas, Presiding.
An Impartial Evaluation of Several Standard Operations for Hip Reconstruction. OTTO J. HERMANN, M.D. Boston.
Chest Injuries. FRANK B. BERRY, M.D., New York.
The Use of Hanging Casts for Fractures of the Shaft of the Humerus. JOHN A. CALDWELL, M.D., Cincinnati.
Evaluation of the Traction Treatment of Fractures of the Os Calcis. JOHN DUNLOP, M.D., Pasadena.
Primary and Secondary Tendon Suture. MICHAEL L. MASON, M.D., Chicago.

SYMPOSIUM ON CANCER

Wednesday, 2:00 p.m.—Rose Garden, Bellevue-Stratford Hotel

FRANK E. ADAIR, M.D., New York, Chairman, Cancer Committee, Presiding.
Radiological Treatment of Cancer of Tongue. HAYES E. MARTIN, M.D., New York.
Surgical Treatment of Cancer of Tongue. LELAND R. COWAN, M.D., Salt Lake City.
Treatment of Cancer of the Esophagus. WILLIAM F. RIENHOFF, JR., M.D., Baltimore.
What Constitutes Malignant Tumors of the Nervous System. ERNEST SACHS, M.D., St. Louis.
Cancer Clinics. BOWMAN C. CROWELL, M.D., Chicago.
Survival Statistics, Cancer of the Breast, 1925–1935, Jefferson Hospital. WILLIAM H. KRAEMER, M.D., Philadelphia.

SYMPOSIUM ON GRADUATE TRAINING FOR SURGERY

Thursday, 3:00 p.m.—Rose Garden, Bellevue-Stratford Hotel

DALLAS B. PHEMISTER, M.D., Chicago; Chairman, Committee on Graduate Training for Surgery, Presiding.

Organizing an Educational Program. WILLIS D. GATCH, M.D., Indianapolis.
Discussion led by GEORGE J. HEUER, M.D., New York.

Supervision of the Educational Program. WALTMAN WALTERS, M.D., Rochester, Minn.

Basic Science Requirements:

Basic Course. WALTER ESTELL LEE, M.D., Philadelphia.

Research. ALEXANDER BRUNSCHWIG, M.D., Chicago.

Organized Study of Surgical Pathology.

Evaluation of Graduate Training—Records, Reports, and Estimates of Work.
WALTER D. WISE, M.D., and HENRY F. BONGARDT, M.D., Baltimore.

General Discussion. HOWARD C. NAFFZIGER, M.D., San Francisco; ALTON OCHSNER, M.D., New Orleans; DONALD GUTHRIE, M.D., Sayre, Pa.

SYMPOSIUM ON THE SURGICAL TREATMENT OF DISEASES OF THE RESPIRATORY TRACT

Friday, 2:00 p.m.—Rose Garden, Bellevue-Stratford Hotel

Principles in the Treatment of Empyema. WILLARD VAN HAZEL, M.D., Chicago.

Relationship of Bronchoscopy to Surgery of the Respiratory Tract. JOHN D. KERNAN, M.D., New York.

Surgical Treatment of Pulmonary Abscess. GEORGE J. HEUER, M.D., New York.

Curability of Primary Carcinoma of the Lung; Early Recognition and Management. RICHARD H. OVERHOLT, M.D., Boston.

Postoperative Pulmonary Complications. DANIEL C. ELKIN, M.D., Atlanta.

SYMPOSIUM ON OBSTETRICS AND GYNECOLOGY

Friday, 2:00 p.m.—North Garden, Bellevue-Stratford Hotel

Some Complications of Pregnancy in which Cesarean Sections Is Indicated. ARTHUR H. BILL, M.D., Cleveland.

The Management of Dystocias of Pregnancy. ALFRED C. BECK, M.D., Brooklyn.

Toxemias of Pregnancy. HERMAN W. JOHNSON, M.D., Houston, Texas.

Prophylaxis and Treatment of Carcinoma of the Cervix and Body of the Uterus. WILLARD R. COOKE, M.D., Galveston, Texas.

Endocrine Therapy in Obstetrics and Gynecology. JOHN C. BURCH, M.D., Nashville, Tenn.

SYMPOSIUM ON UROLOGY

Friday, 2:00 p.m.—South Garden, Bellevue-Stratford Hotel

End Results in Carcinoma of the Bladder Treated by Radium. BENJAMIN S. BARRINGER, M.D., New York.

Urologic Aspects of Hypertension. DAVID W. MACKENZIE, M.D., Montreal.

Perirenal Infections. HOMER G. HAMER, M.D., Indianapolis.

Some Complications and Dangers of the Lower Ureteral Calculus. JOHN K. ORMOND, M.D., Detroit.

The Development of Prostatic Hyperplasias. CLYDE L. DEMING, M.D., New Haven.

MIDDAY PANEL DISCUSSIONS

Tuesday, 12:30 to 1.45 p.m.—Bellevue-Stratford

Rose Garden

Delayed Union and Non-Union of Fractures. ROBERT H. KENNEDY, M.D., New York, Presiding.

South Garden

Brain Abscess. CHARLES BAGLEY, JR., M.D., Baltimore, Presiding.

Palm Garden

Sterilization and Aseptic Operating Room Technique. ELLIOT C. CUTLER, M.D., Boston, Presiding.

North Garden

Pre- and Postoperative Drugs Used in Gastro-intestinal Surgery. IDYS MIMS GAGE, M.D., New Orleans, Presiding.

Wednesday, 12:30 to 1:45 p.m.—Bellevue-Stratford

Rose Garden

Biliary Tract Surgery and the Bad Risk Case. ARTHUR W. ALLEN, M.D., Boston, Presiding.

South Garden

Treatment of Varicose Veins. H. O. MCPHEETERS, M.D., Minneapolis, Presiding.

North Garden

Vitamins and Surgery. CHARLES B. PUESTOW, M.D., Chicago, Presiding.

Palm Garden

Factors Preventing Ammonia Formation in Preserved Blood. JOHN SCUDDER, M.D., New York, Presiding.

Thursday, 12:00 M. to 1:15 p.m.—Bellevue-Stratford

North Garden

Ulcerative Colitis. HENRY W. CAVE, M.D., New York, Presiding.

South Garden

The Recognition and Management of Hyperthyroidism. GEORGE M. CURTIS, M.D., Columbus, Ohio, Presiding.

Palm Garden

Postoperative Wound Disruption—Methods of Closure. ARTHUR M. SHIPLEY, M.D., Baltimore, Presiding.

Friday, 12:30 to 1:45 p.m.—Bellevue-Stratford

Rose Garden

Analgesia and Anesthesia in Obstetrics. HOWARD F. KANE, M.D., Washington, Presiding.

Palm Garden

Postoperative Infections. FRANK L. MELENEY, M.D., New York, Presiding.

North Garden

The Management of Cleft Lip and Cleft Palate. GEORGE WARREN PIERCE, M.D., San Francisco, Presiding.

South Garden

Indications for Surgical Treatment of Renal Tuberculosis. GILBERT J. THOMAS, M.D., Minneapolis, Presiding.

ASSEMBLY OF INITIATES

Monday, 11:00 a.m.—Palm Garden, Bellevue-Stratford Hotel

Opening Remarks. HOWARD C. NAFFZIGER, M.D., San Francisco, President.

The Program of the American College of Surgeons:

IRVIN ABELL, M.D., Louisville, Vice Chairman, Board of Regents.

BOWMAN C. CROWELL, M.D., Chicago, Associate Director.

MALCOLM T. MACEACHERN, M.D., Chicago, Associate Director.

The Fellowship Pledge. Recital by Initiates.

Greetings to the Initiates. GEORGE P. MULLER, M.D., Philadelphia, President-elect.

Closing Remarks. GEORGE CRILE, M.D., Cleveland, Chairman, Board of Regents.

Signing of the Fellowship Roll. The Initiates.

ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday, 10:00—Rose Garden, Bellevue-Stratford Hotel

HOWARD C. NAFFZIGER, M.D., San Francisco; President American College of Surgeons, presiding.

Address of President—The Hospital Program of the American College of Surgeons.

The 1939 Hospital Standardization Survey—Official Announcement of the List of Approved Hospitals. GEORGE CRILE, M.D., Cleveland; Chairman, Board of Regents, American College of Surgeons.

Present Trends in Graduate Training for Surgery. DALLAS B. PHEMISTER, M.D., Chicago.

The Preservation of our Present Voluntary Hospital System. REV. A. M. SCHWITALLA, S.J., St. Louis.

Educated and Trained Personnel Essential for Maintaining Proper Standards of Service in the Care of the Hospitalized Patient. FRED G. CARTER, M.D., Cleveland.

The Rôle of the Hospital in Graduate Education for the Physician or Surgeon Desirous of Proper Preparation for his Specialty. ROBIN C. BUERKI, M.D., Chicago.

Essential Qualifications of an Efficient Hospital Administrator. JAMES A. HAMILTON, New Haven, Conn.

General Discussion. Opened by GEORGE P. MULLER, M.D., Philadelphia.

Monday, 2:00—Rose Garden, Bellevue-Stratford Hotel

FRASER B. GURD, M.D., Montreal, Vice President, American College of Surgeons, presiding.

Opening Remarks—Hospital Standardization in Canada. FRASER B. GURD, M.D., Montreal.

A Study of Nursing Hours in the Care of Various Types of Patients. ALBERT H. SCHEIDT, Chicago.

Relation of Dietary Deficiencies to Surgical Convalescence. CHARLES B. PUESTOW, M.D., Chicago.

The Hospital Trustee and His Proper Conception of Administrative and Professional Practices. RAYMOND P. SLOAN, New York.

The Significance of Research and Statistics in the Hospital Field. ARNOLD F. EMCH, Ph.D., Chicago.

Criteria for an Efficient Graduate Nursing Service, with Special Reference to Administrative Policies of the Hospital. ALMA H. SCOTT, R.N., New York.

General Discussion. Opened by LEWIS E. JARRETT, M.D., Richmond, Va.

Tuesday, 10:00—Rose Garden, Bellevue-Stratford Hotel

CLAUDE W. MUNGER, M.D., New York, presiding.

General Theme: The Medical Staff, Its Organization and Function.

The Importance of an Efficient Medical Staff to a Hospital. HARVEY AGNEW, M.D., Toronto.

Discussion from the standpoints of:

- What Constitutes a Medical Staff? OSWALD N. ANDERSON, M.D., St. Louis.
- The Right of the Governing Board of the Hospital to Appoint the Medical Staff. JOSEPH C. DOANE, M.D., Philadelphia.
- Proper Procedure to Follow When Extending Hospital Privileges and Making Appointments to the Medical Staff. CHARLES H. YOUNG, M.D., Montclair, N. J.
- Selection and Appointment of Chief of Staff and Heads of Departments. JESSIE J. TURNBULL, R.N., Pittsburgh.
- Accounting of Professional Services as a Means of Controlling Clinical Work. THOMAS R. PONTON, M.D., Chicago.

General Discussion. Opened by JOE R. CLEMMONS, M.D., New York.

Tuesday, 2:00—South Garden, Bellevue-Stratford Hotel

Panel Round Table Discussion. General Theme: The Organization and Management of the Small Hospital. Conducted by ROBERT JOLLY, Houston, Texas.

The Importance of the Small Hospital in Certain Communities. CHARLES A. LINDQUIST, Elgin, Ill.

Discussion from the following viewpoints:

- Personnel: Securing adequate personnel, minimizing turnover, maintaining good morale, training hospital personnel. MILDRED WALKER, Wauseon, Ohio.
- Medical Staff Organization: Selecting and organizing the medical staff, controlling the clinical work, conducting medical staff conferences. HUSTON K. SPANGLER, M.D., Chicago.
- Medical Records: Securing medical records, filing and preserving medical records, using medical records. JAMES H. SPENCER, JR., M.D., Franklin, N. J.
- Clinical Laboratory Service: Providing adequate service, maintaining competent technical services, supervision and financing the clinical laboratory. LALL G. MONTGOMERY, M.D., Muncie, Ind.
- X-ray Service: Providing adequate service, maintaining competent technical services, supervising and financing the x-ray department. DAVID M. CALDWELL, M.D., Manchester, Conn.
- Nursing Service: Providing adequate service, supplementing nursing service with attendants or subsidiary workers, determining personnel requirements, maintaining permanency in personnel. EDNA D. PRICE, R.N., Concord, Mass.
- Financing: Assuring accounting efficiency, utilizing all sources of revenue, collecting delinquent accounts, stimulating philanthropic endeavor. O. K. FIKE, Richmond, Va.

Tuesday, 2:00—Rose Garden, Bellevue-Stratford Hotel

Panel Round Table Discussion: Problems Pertaining to Various Phases of Hospital Administration in the Large Hospital. Conducted by WILMAR M. ALLEN, M.D., Hartford, Conn.

- Administration: Maintaining good morale among hospital personnel, admitting and discharging procedure, responsibility for scientific work, conferences of administrator with heads of departments. J. C. MACKENZIE, M.D., Montreal.
- Accounting Control and Hospital Costs: Budget—predetermined costs, control of purchases, personnel, day by day control; issuance of food, medical supplies, etc.; total costs, functional costs, per capita costs (in and out-patients). GORDON T. BROAD, New York.
- Anesthesia: Essentials of a properly organized department, responsibility for selection of type of anesthetic to be used, pre-anesthetic examination of patient, elimination of anesthetic hazards. MILTON C. PETERSON, M.D., New York.
- Emergencies: Organization of emergency services, shock, hemorrhage, and poisoning, blood transfusion, emergency lighting in the hospital. JOHN M. T. FINNEY, JR., M.D., Baltimore.
- Control of Postoperative Infections from the Standpoint of Surgical Instruments: Unsterilized versus sterilized instruments, technique for cleansing and sterilizing surgical instruments, decreased inventory of surgical instruments, labor saving and other factors, in postoperative infections. CARL W. WALTER, M.D., Boston.
- Hospitalization and Compensation Charges: For hospitalization patients, for compensation or insurance

patients, uniform charges, co-operative action among hospitals. NORA E. YOUNG, R.N., Brooklyn.

Tuesday, 8:00 p.m.—St. Joseph's Hospital

Round Table Conference—Presentation and Discussion of Pertinent Hospital Problems Submitted by Hospital Executives. Conducted by ROBERT JOLLY, Houston, Texas, and MALCOLM T. MACEACHERN, M.D., Chicago.

Wednesday, 9:30—Rose Garden, Bellevue-Stratford Hotel

Joint Conference with American Association of Medical Record Librarians. ROBIN C. BUERKI, M.D., Chicago, presiding.

A Preview of the Present Status of Medical Records in the United States and Canada as seen by the American College of Surgeons. EARL W. WILLIAMSON, M.D., Chicago.

The Present Status of the Training of Medical Records Librarians. LILLIAN H. ERICKSON, R.R.L., Chicago.

Difficulties in Securing Good Medical Records in the Small Hospital and What We Have Done to Overcome Them. GENEVIEVE HILGER, R.R.L., Decorah, Iowa.

The Place of the Medical Secretary in the Hospital. RUTH HESS, R.R.L., Bluefield, W. Va.

Overcoming Problems Incident to Securing Acceptable Specialty Medical Records. RAY K. DAILY, M.D., Houston, Texas.

Round Table Conference—Medical Records Problems. Conducted by W. FRANKLIN WOOD, M.D., Waverley, Mass.

Wednesday, 2:00—Demonstrations in Local Hospitals

Children's Hospital. SUSAN C. FRANCIS, R.N., Superintendent.
- Pediatric Nursing Care and Isolation Precautions:
  - Infantile Eczema. DONALD M. PILLSBURY, M.D.
  - Children in Chapple Cabinet Cubicles. CHARLES C. CHAPPLE, M.D.
- Administration of Blood Transfusions to Infants. AIMS C. MCGUINNESS, M.D.
- Procedure and Technique in Making Up Infant Feedings—Milk Laboratory. AGNES H. ADDAMS and ARLENE SALEN.

Graduate Hospital of the University of Pennsylvania. DONALD C. SMELZER, M.D., Director.
- Organization and Management of a Blood Bank. FRANK JONES, M.D., MELBA FISHBAUGH, and MARGUERITE LUKENS.
- Central Solution Room. ALEXANDER KELLER and MARGARET HIPPLE.
- Technique of Preparation and Administration of Parenteral Solutions. FRANK JONES, M.D., and JOSEPHINE FAMBROUGH.

Hospital of the University of Pennsylvania. MARY V. STEPHENSON, Superintendent.
- Central dressing room; pediatric bedside clinic (nursing techniques); use of the out-patient department in teaching the student nurse; resuscitation and oxygen therapy from the physician's and nurse's viewpoint; the nurse's responsibility in Wangensteen suction drainage, blood transfusions, and venoclysis; demonstration of vasocillator bed.

Lankenau Hospital. ROBERT SHOEMAKER, M.D., Executive Medical Officer.
- Organization and Management of Medical Records Department. GILSON C. ENGEL, M.D., and staff.
- Follow-up and Study of End Results. STANLEY P. REIMANN, M.D., and staff.

United States Naval Hospital. Captain HENRY L. DOLLARD, M.C., Commanding Officer.
- Physical Therapy. Lieut. CARL K. YOUNGKIN.

Jefferson Medical College Hospital. ROBERT B. NYE, M.D., Medical Director.
- Organization, management, and clinic methods—Curtis Clinic; Motion picture technique. ROBERT B. NYE, M.D., and HAYWARD R. HAMRICK, M.D.

Thursday, 9:30—Rose Garden, Bellevue-Stratford Hotel

DONALD C. SMELZER, M.D., Philadelphia, presiding.

Interference with Radio Reception Caused by Electro-Medical Equipment. H. B. WILLIAMS, M.D., New York.

Organization and Operating Problems of a Tumor Unit in a General Hospital. JOSEPH TENOPYR, M.D., Brooklyn.

Principles of Relationship Between Radiologists and Hospitals. B. R. KIRKLIN, M.D., Rochester, Minn.

Principles of Relationship Between Pathologists and Hospitals. FRANK HARTMAN, M.D., Detroit.

Principles of Relationship Between Anesthetists and Hospitals. EMERY A. ROVENSTINE, M.D., New York.

General Discussion. Opened by BASIL C. MACLEAN, M.D., Rochester, N. Y.

Thursday, 2:00—Demonstrations in Local Hospitals

Pennsylvania Hospital (Woman's Building). NORRIS W. VAUX, M.D., Obstetrician and Gynecologist-in-Chief.

Maternal Care, Obstetrical Technique, and Procedure:
- Admission of Patient and Assignment to Accommodation. SPOTSWOOD ROBINS, M.D.
- Prenatal Care. J. VERNCN ELLSON, M.D.
- Special Clinics. CRAIG WRIGHT MUCKLE, M.D.
- Preparation of Patient. ROBERT M. SHIREY, M.D.
- Observation of Patient in Labor. ROSS B. WILSON, M.D.
- Delivery Room Set-up, Obstetrical Technique and Procedures. CLIFFORD B. LULL, M.D.
- Care of the Patient Immediately Postpartum. JOHN C. ULLERY, M.D.
- Care of the Patient Throughout Puerperium While in the Hospital. ROBERT A. KIMBROUGH, M.D.
- Follow-up and End Results. F. SIDNEY DUNNE, M.D.
- Out-Patient Clinic. PENDLETON TOMPKINS, M.D.
- Care of the Newborn. RALPH M. TYSON, M.D.

Pennsylvania Hospital. JOHN N. HATFIELD, Administrator.
- Food Service. MARGARET J. BENNETT.

Philadelphia General Hospital. WILLIAM G. TURNBULL, M.D., Superintendent.
- Organization and Management of a Blood Bank. I. S. HNELESKI, M.D.
- Nursing Technique. LORETTA M. JOHNSON, R.N.

Wills Hospital. STEPHEN WIERZBICKI, Superintendent.
- Development of Consultation Clinics in Specialty Hospitals. JOSEPH V. KLAUDER, M.D., and WILLIAM FRANICS WHELAN, M.D.
- Nursing and Operating Room Technique in an Eye Hospital. GLADYS E. COLE and HILDA R. MILLER.

PRELIMINARY CLINICAL PROGRAM

ARRANGED IN THE FOLLOWING SUBDIVISIONS: GENERAL SURGERY, OBSTETRICS AND GYNECOLOGY, SURGERY OF BONES AND JOINTS, GENITO-URINARY SURGERY, FRACTURES AND OTHER TRAUMAS, NEUROSURGERY, THORACIC SURGERY, PLASTIC AND FACIOMAXILLARY SURGERY, BRONCHO-ESOPHAGOLOGY, OTORHINOLARYNGOLOGY, OPHTHALMOLOGY.

GENERAL SURGERY

Monday

HOSPITAL FOR DISEASES OF STOMACH

FRANCIS A. MANTZ—1. Operative and dry clinic.

JEFFERSON HOSPITAL

ROBERT LAYTON and SHERMAN EGER—11. Varicose veins.
J. HALL ALLEN and BENJAMIN HASKELL—1:30. Lesions of the anus and rectum.
HENRY K. MOHLER—2. Therapeutics in surgery.

MOUNT SINAI HOSPITAL

MOSES BEHREND and staff—1:15. Operations.

PENNSYLVANIA HOSPITAL

ORVILLE C. KING—2. Spinal anesthesia.
GARFIELD C. DUNCAN—3. Management of diabetes during acute infections and surgical complications.
SAMUEL BRADBURY—4. Surgical follow-up and group practice.

PHILADELPHIA GENERAL HOSPITAL

HUBLEY R. OWEN, JOHN PAUL NORTH, and LEWIS C. MANGES—1:30. Operative and dry clinic.
JOSEPH MCFARLAND and staff—2. Radiological clinic: Diagnosis of new cases; review of old cases and group discussion.
RUBIN M. LEWIS and staff—3:30. Treatment of varicose veins and their complications.
I. S. HNELESKI and ELEANOR VALENTINE—3. Management of blood bank at the Philadelphia General Hospital; demonstration of apparatus, technique of venesection and transfusion, and laboratory studies on refrigerated blood.

STETSON HOSPITAL

ROBERT S. ALSTON, C. E. SCHWARTZ, and TROY E. MARTIN—2. Operations.
CARL F. KOENIG—2. X-ray clinic.

TEMPLE UNIVERSITY HOSPITAL

WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. Dry clinic: General and emergency surgery.
HARRY Z. HIBSHMAN, HARRY E. BACON, and staff—3. Operative and dry clinic.
CARROLL S. WRIGHT—3. Dermatology and syphilology.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—9. Operations: Cholecystectomy.

Tuesday

ABINGTON MEMORIAL HOSPITAL

JOHN EIMAN—2. Chemical problems in surgery.

AMERICAN ONCOLOGIC HOSPITAL

GEORGE M. DORRANCE, JOHN W. BRANSFIELD, and FREDERICK A. BOTHE—10. Operative and dry clinic: Cancer of rectum.
JOSEPH MCFARLAND—11. Pathological demonstration: Cancer of rectum.

BRYN MAWR HOSPITAL

JOHN B. FLICK and FREDERICK R. ROBBINS—9. Operations.
MAX STRUMIA—2. Surgical pathology. (Blood pictures in surgical infections with special emphasis on neutrophiles.)

CHESTNUT HILL HOSPITAL

JOHN F. MCCLOSKEY, JAMES A. LEHMAN, J. M. ELLZEY, JR., and JOHN J. SHOBER—10. Operations.

CHILDREN'S HOSPITAL

ORVILLE KING—11. Splenomegaly in children.

FITZGERALD-MERCY HOSPITAL

JAMES A. KELLY—9. Operations.
THOMAS J. RYAN—9. Operations.

FRANKFORD HOSPITAL

LOUIS D. ENGLERTH—9. Operative and dry clinic.

GERMANTOWN HOSPITAL

EDWARD B. HODGE, WILLIAM B. SWARTLEY, ROBERT S. ALSTON, and STEPHEN D. WEEDER—10. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WILLIAM BATES—9. Operations.
JOHN C. HOWELL and I. I. GOPADZE—11. Operations.

HAHNEMANN HOSPITAL

A. B. WEBSTER—9. Operations.

HOSPITAL FOR DISEASES OF STOMACH

HERBERT R. HAWTHORNE, WILBUR W. OAKS, and PAUL H. NEESE—9. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

I. S. RAVDIN and staff—9. Biliary tract operations.
J. E. RHOADS. The management of the hemorrhagic tendency of obstructive jaundice.
I. S. RAVDIN. The relation of diet to liver injury.
W. D. FRAZIER. The control of the external loss of bile.
O. V. BATSON. Incisions for biliary tract operations.
IVAN TAYLOR. Anesthesia in biliary tract operations.
I. S. RAVDIN. End-results in biliary tract surgery.

L. K. FERGUSON, LOUIS KAPLAN and WILLIAM H. ERB—2. Painful shoulder: The differential diagnosis and treatment of painful lesions of the shoulder; acute subdeltoid bursitis; chronic bursitis; supraspinatus tendon rupture; brachial plexus neuritis with scalenus myositis.

JEANES HOSPITAL

ROSCOE M. TEAHAN, HOKE WAMMOCK, and CLARENCE A. WHITCOMB—9. Operations: Panhysterectomy for carcinoma of uterine fundus; application of radium for carcinoma of cervix; vulvectomy for carcinoma; radical neck dissection for metastatic carcinoma.

Staff—11. Dry clinic:

W. S. HASTINGS. A review of proposed methods of serological diagnosis of cancer.

A. M. DUFF, JR. The rapid diagnosis of fresh tissue.

HOKE WAMMOCK. The control of pain of advanced cancer with irradiation.

C. A. WHITCOMB. Presentation of treated oral lesions.

JEFFERSON HOSPITAL

THOMAS A. SHALLOW and staff—10. Operations; ward walks.

CHARLES F. NASSAU—11. Operations; ward walks.

GEORGE P. MULLER—2. Operative and dry clinic.

J. HALL ALLEN and BENJAMIN HASKELL—3. Proctological surgery.

LANKENAU HOSPITAL

DAMON B. PFEIFFER, J. MONTGOMERY DEAVER or DR. MARTIN—9. Operations. Presentations: Acute appendicitis in children; aneurysm of the abdominal aorta simulating surgical kidney.

MEMORIAL HOSPITAL

JAMES LEHMAN—9. Thyroid operations.

METHODIST EPISCOPAL HOSPITAL

CALVIN M. SMYTH, JR. and staff—9:30. Operations.

MISERICORDIA HOSPITAL

B. R. BELTRAN and E. J. GARVIN—9. Operations.

GEORGE P. MULLER, F. MOGAVERO and F. T. MCGINNIS—9. Operations.

MOUNT SINAI HOSPITAL

BENJAMIN LIPSHUTZ and staff—9. Operations.

NORTHEASTERN HOSPITAL

JOSEPH J. TOLAND—9. Operations.

PENNSYLVANIA HOSPITAL

WALTER E. LEE and staff—9. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

L. K. FERGUSON and WILLIAM H. ERB—9. Operative and dry clinic.

DAVID P. ANDERSON, JR.—9. End-results of herniorrhaphy; Ferguson operation plus steel wire sutures.

Staff—2. Symposium on biliary tract and gastric diseases:

L. K. FERGUSON. Biliary tract surgery.

TRUMAN G. SCHNABEL. Biliary tract disease from a medical standpoint.

E. BURVILLE-HOLMES. Roentgenological diagnosis of biliary tract disease.

RUSSELL S. BOLES, HELENA RIGGS and JOHN GRIFFITHS. Circulatory factors in the etiology of peptic ulcer.

W. WAYNE BABCOCK. Gastric surgery.

HERMAN OSTRUM. Roentgenological aspects of gastric disease.

WILLIAM BRODY. Use of gastroscope in gastric disease.

I. S. HNELESKI and ELEANOR VALENTINE—3. Management of blood bank at the Philadelphia General Hospital; demonstration of apparatus, technique of venesection and transfusion, and laboratory studies on refrigerated blood.

PRESBYTERIAN HOSPITAL

EDWARD B. HODGE, ERNEST G. WILLIAMSON, and LYNN M. RANKIN—9. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

I. M. BOYKIN and staff—9. Operations.

ST. CHRISTOPHER'S HOSPITAL

HARRY E. KNOX, JOHN WOLF and DR. MARTIN—10. Pediatric surgery.

ST. JOSEPH'S HOSPITAL

V. G. BURDEN—10. Dry clinic: Duodenal ulcer; pylorospasm; infantile pyloric stenosis.

ST. LUKE'S AND CHILDREN'S HOSPITAL

DESIDERIO ROMAN, R. W. LARER, H. K. ROESSLER, A. W. HAMMER and staff—9. Operative clinic: Thyroid; gall bladder; carcinoma of the breast; herniorrhaphies.

JOHN O. BOWER and staff—9. Dry clinic: Operations on the stomach, showing advantages in use of very fine size catgut.

J. W. POST—9. Roentgenological examinations.

O. F. BARTHMAIER—9. Demonstration: Pathological and bacteriological examinations.

ST. MARY'S HOSPITAL

W. J. RYAN and J. J. CANCELMO—9. Operations.

V. R. MANNING—1. Proctological clinic.

ST. VINCENT'S HOSPITAL

J. J. CANCELMO—9. Operative and dry clinic: Cryptorchidism, its reduction by operative measures.

TEMPLE UNIVERSITY HOSPITAL

W. WAYNE BABCOCK, G. MASON ASTLEY, W. EMORY BURNETT, and J. NORMAN COOMBS—9. Operations.

W. EDWARD CHAMBERLAIN and staff—9. Radiological clinic.

WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. General and emergency surgery.

U. S. NAVAL HOSPITAL

F. L. CONKLIN, W. T. LINEBERRY, and H. L. PUGH—9. Operations.

J. J. WHITE—9. Demonstration: Kettering-Simpson hypertherm.

J. J. WHITE—1. Demonstration: Kettering-Simpson hypertherm.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—10. Operations: Cholecystectomy and appendectomy.

WOMEN'S HOMEOPATHIC HOSPITAL

LAWRENCE GOLDBACHER—3. Rectal surgery.

WOMAN'S MEDICAL COLLEGE HOSPITAL

J. STEWART RODMAN and associates—10:30. Operations.

Wednesday

ABINGTON MEMORIAL HOSPITAL

DAMON B. PFEIFFER, J. WALTER LEVERING, and J. M. DEAVER—2. Operations.

BROAD STREET HOSPITAL

A. B. WEBSTER and T. C. GEARY—10. Operations.

BRYN MAWR HOSPITAL

ARTHUR E. BILLINGS and CHARLES H. HARNEY—9. Operations.

CHESTNUT HILL HOSPITAL

WILLIAM B. SWARTLEY, S. DANA WEEDER, EDWARD F. MCLAUGHLIN, and WILLIAM SWARTLEY RINKER—10:30. Operations.

COOPER HOSPITAL

PAUL M. MECRAY, I. E. DEIBERT, F. W. SHAFER, and R. S. GAMON—9. Operative and dry clinic: Abdominal and thoracic surgery; empyema.

FITZGERALD-MERCY HOSPITAL

BASIL R. BELTRAN—9. Operations.
ALEXANDER E. BURKE—9. Operations.

FRANKFORD HOSPITAL

BENJAMIN H. CHANDLEE and RALPH W. LORRY—9. Operations.

GERMANTOWN HOSPITAL

CHARLES F. MITCHELL, WALTER E. LEE, HARRY E. KNOX, and THOMAS M. DOWNS—10. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WALTER E. LEE—9. Operative and dry clinic: Constrictive pericarditis.
GEORGE M. PIERSOL, GEORGE C. GRIFFITH, and WALTER E. LEE—10. Dry clinic: Calcified constricting pericarditis, medical and surgical aspects.
JOSEPH T. BEARDWOOD, JR., JOSEPH C. YASKIN, and WALTER E. LEE—11. Symposium: Pancreatic adenoma with hyperinsulinism, metabolic, neurological, and surgical aspects.
COLLIER F. MARTIN—2. Lymphogranuloma venereum.

HAHNEMANN HOSPITAL

G. A. VAN LENNEP—9. Operations.

HOSPITAL FOR DISEASES OF STOMACH

SHERMAN A. EGER—9. Operative and dry clinic.
HERBERT R. HAWTHORNE, WILBUR W. OAKS, and PAUL H. NEESE—12. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

E. L. ELIASON and staff—9. Operations: Biliary surgery.
JULIAN JOHNSON. Management of acute cholecystitis.
ROBERT B. BROWN. Hazards of cholecystectomy.
WILLIAM H. ERB. Pancreatitis and gall-bladder disease.
E. L. ELIASON. Surgical jaundice.
LLOYD W. STEVENS. Biliary fistula.
I. S. RAVDIN and staff—2. Dry clinic on pre- and postoperative care.
I. S. RAVDIN. The control of fluid balance and nutrition in surgical patients.
FRANCIS WOOD. The heart in surgical patients.
H. C. BAZETT. The effect of climatic conditions on blood volume.
J. H. GIBBON, JR. The problem of embolus in surgical patients.
J. E. RHOADS. The use of sulfanilamide in spreading peritonitis.
S. GOLDSCHMIDT. The danger of anoxemia during surgical operations.
J. S. LOCKWOOD. The mode of action of sulfanilamide and related compounds.
NORMAN FREEMAN. The management of surgical shock.
I. S. RAVDIN. The effect of recent advances of pre- and postoperative treatment on the morbidity and mortality of surgical operations.
L. K. FERGUSON, PAUL LOEFFLAD, WILLIAM H. ERB, LOUIS KAPLAN, and NORMAN FREEMAN—2. Treatment of varicose veins and ulcers; injection treatment of varicose veins; indications for and technique of ligation in the treatment of varicose veins; treatment of varicose ulcers; treatment of painful arteriosclerotic ulcers.

JEFFERSON HOSPITAL

GEORGE P. MULLER and staff—9. Dry clinic:
ADOLPH A. WALKLING. Cholangiography.
GEORGE P. MULLER. Subtotal gastrectomy.
JAMES SURVER. Carcinoma of breast; tumor clinic follow-up study over a 10 year period.
GEORGE P. MULLER and staff—11. Operations.
ROBERT LAYTON and SHERMAN EGER—11. Varicose vein clinic.
J. HALL ALLEN and BENJAMIN HASKELL—1:30. Lesions of the anus and rectum.
THOMAS A. SHALLOW—2. Operations: Colon and rectum.

JEWISH HOSPITAL

RALPH GOLDSMITH—9. Operations.
MOSES BEHREND—2. Operations.

LANKENAU HOSPITAL

GEORGE P. MULLER, GILSON C. ENGEL, JOSEPH O. KEEZEL or HANS MAY—9. Surgical operations. Studies from the clinical and research laboratory upon cancer growth, etc. Demonstration in the technique of the use of the Engel-May range finder and Smith-Petersen nail, end-results and pathological studies.

MEMORIAL HOSPITAL

BRUCE L. FLEMING—9. Operations.

METHODIST EPISCOPAL HOSPITAL

GEORGE J. SCHWARTZ and staff—10. Operations.

MISERICORDIA HOSPITAL

JAMES A. KELLY and D. C. GEIST—9. Operations.

NORTHERN LIBERTIES HOSPITAL

BYRON GOLDSMITH and MORRIS SEGAL—9. Operative clinic.

PENNSYLVANIA HOSPITAL

PAUL A. BISHOP—2. Dry Clinic: Acute intestinal obstruction, with x-ray diagnosis and special reference to the Abbott tube.
WILLIAM A. WOLFF and RUSSELL ELKINTON—4. Dry Clinic: Chemical control of surgical patients.

PHILADELPHIA GENERAL HOSPITAL

W. WAYNE BABCOCK—9. Dry clinic.
WILLIAM T. LEMMON—9. Operative clinic: Gall-bladder disease.
JOHN O. BOWER, JOHN C. BURNS, and HARRY B. TRACHTENBERG—9. Demonstration of use of very fine size

catgut in gastro-intestinal surgery; management of spreading peritonitis due to perforated appendix, with special reference to the use of convalescent lyophilize serum.

HENRY S. RUTH—11. Choice of anesthetics in surgery.

I. S. HNELESKI and ELEANOR VALENTINE—3. Management of blood bank at the Philadelphia General Hospital; demonstration of apparatus, technique of venesection, and transfusion and laboratory studies on refrigerated blood.

PRESBYTERIAN HOSPITAL

WILLIAM BATES, JAMES B. MASON, and JOHN C. HOWELL—9. Dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

Staff—9. Dry clinic:
M. L. ALLEN. X-ray therapy of inflammation.
I. M. BOYKIN. Problems in gall-bladder surgery.
R. L. LAYTON. Amputation in diabetic gangrene.
R. H. MEADE, Jr. Acute pancreatitis.

ST. JOSEPH'S HOSPITAL

S. D. SPOTTS—9. Operations.

CHARLES F. NASSAU—10. Operations.

L. A. SOLOFF—3. Laboratory demonstration of surgical pathology.

ST. LUKE'S AND CHILDREN'S HOSPITAL

DESIDERIO ROMAN, R. W. LARER, H. K. ROESSLER, A. W. HAMMER, and staff—9. Operative clinic.

J. W. POST—9. Roentgenological examinations.

O. F. BARTHMAIER—9. Demonstration: Pathological and bacteriological examinations.

ST. MARY'S HOSPITAL

A. P. KEEGAN—9. Operations.

STETSON HOSPITAL

WILLIAM T. ELLIS and J. K. MARKS—12. Operations.

CARL E. KOENIG—2. X-ray clinic.

ROBERT S. ALSTON, C. E. SCHWARTZ, and TROY E. MARTIN—2. Operations.

TEMPLE UNIVERSITY HOSPITAL

W. WAYNE BABCOCK, G. MASON ASTLEY, W. EMORY BURNETT, and J. NORMAN COOMBS—9. Operations.

W. EDWARD CHAMBERLAIN and staff—9. Radiological clinic.

WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. General and emergency surgery.

HARRY Z. HIRSHMAN, HARRY E. BACON and staff—3. Operative and dry clinic.

U. S. NAVAL HOSPITAL

F. L. CONKLIN, W. T. LINEBERRY, and H. L. PUGH—9. Operations.

J. J. WHITE—9. Demonstration: Kettering-Simpson hypertherm.

J. J. WHITE—1. Demonstration: Kettering-Simpson hypertherm.

C. K. YOUNGKIN—2. Demonstration: Physical therapy.

C. F. MORRISON—2. Demonstration: Spinograms.

WOMEN'S HOMEOPATHIC HOSPITAL

R. W. LARER—9. Operations.

WILLIAM L. MARTIN—1. Operations.

C. L. SHOLLENBERGER—1. Operations.

Thursday

ABINGTON MEMORIAL HOSPITAL

DAMON B. PFEIFFER, J. WALTER LEVERING, I. M. BOYKIN, J. M. DEAVER, and staff—2. Dry clinic: Peptic ulcer and its surgical complications.

BRYN MAWR HOSPITAL

RALPH S. BROMER—9. X-ray conference: Diseases of bone.

J. STEWART RODMAN and ALAN P. PARKER—9:30. Operations.

CHESTNUT HILL HOSPITAL

WILLIAM C. SHEEHAN, L. H. HERGESHEIMER, HANS MAY, and H. P. MACNEAL—10. Operations.

FAY K. ALEXANDER—11. Intra-abdominal hernia, x-ray studies.

CHILDREN'S HOSPITAL

WALTER E. LEE and FREDERICK ROBBINS—11. Operations and ward rounds: Surgery in children.

COOPER HOSPITAL

PAUL M. MECRAY, I. E. DEIBERT, F. W. SHAFER, and R. S. GAMON—9. Operative and dry clinics: General surgery, fractures, carcinoma of breast.

FITZGERALD-MERCY HOSPITAL

JAMES A. KELLY—9. Operations.

THOMAS J. RYAN—9. Operations.

FRANKFORD HOSPITAL

CHARLES F. NASSAU—9. Operations.

GERMANTOWN HOSPITAL

EDWARD B. HODGE, WILLIAM B. SWARTLEY, ROBERT S. ALSTON, and STEPHEN D. WEEDER—10. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

HERBERT R. HAWTHORNE—9. Operations.

HAHNEMANN HOSPITAL

WILLIAM L. SYLVIS—9. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

I. S. RAVDIN and staff—9. Gastro-intestinal operations.
I. S. RAVDIN. The effect of nutritional edema on failure of stomach to empty.
ALFRED STENGEL, JR. Nutrition in gastro-intestinal cases.
W. D. THOMPSON, JR. Factors conditioning wound healing in surgical patients.
W. O. ABBOTT. The use of the Miller-Abbott tube in acute intestinal obstruction.
W. D. FRAZIER. Indications for operation in patients with gastric or duodenal ulcer.

JEFFERSON HOSPITAL

KENNETH E. FRY—9. Peritoneoscopy as a diagnostic aid in surgery.

THOMAS A. SHALLOW and staff—10. Ward walks.

THOMAS A. SHALLOW and staff—11. Operations.

HOBART A. REIMANN—2. Medico-surgical problems.

J. HALL ALLEN and BENJAMIN HASKELL—3. Proctological operations.

JEANES HOSPITAL

ROSCOE M. TEAHAN, HOKE WAMMOCK, and CLARENCE A. WHITCOMB—9. Operations: Abdominoperineal resec-

tion of rectum; excision of carcinoma of bladder; implantation of radon for carcinoma of mouth.
Staff—11. Dry clinic.
W. S. HASTINGS. A review of proposed methods of serological diagnosis of cancer.
A. M. DUFF, JR. The rapid diagnosis of fresh tissue.
HOKE WAMMOCK. The control of pain of advanced cancer with irradiation.
C. A. WHITCOMB. Presentation of treated oral lesions.

JEWISH HOSPITAL

FRANK B. BLOCK—9. Operations.

LANKENAU HOSPITAL

DAMON B. PFEIFFER, J. MONTGOMERY DEAVER or DR. MARTIN—9. Surgical operations. Discussion of cancer of rectum with report of cases.

METHODIST EPISCOPAL HOSPITAL

CALVIN M. SMYTH, JR. and staff—9. Operations.

MISERICORDIA HOSPITAL

B. R. BELTRAN and E. GARVIN—9. Operations.
GEORGE P. MULLER, F. MOGAVERO, and F. T. MCGINNIN—9. Operations.

MOUNT SINAI HOSPITAL

BENJAMIN LIPSHUTZ and staff—9. Operations.

PENNSYLVANIA HOSPITAL

WALTER E. LEE and staff—9. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

LOUIS D. ENGLERTH, S. DALE SPOTTS, and HUGH ROBERTSON—9. Operative and dry clinic.
L. K. FERGUSON and WILLIAM H. ERB—9. Operative clinic.
Staff—9. Symposium on metabolic diseases:
EDWARD S. DILLON. Surgical complications of diabetes mellitus.
WILLIAM H. ERB. Diabetic surgery.
ROBERT G. TORREY. Medical aspects of diseases of thyroid gland.
PATRICK A. MCCARTHY. Surgery of thyroid gland.
Staff—2. Symposium on cancer:
LOUIS H. CLERF. Carcinoma of larynx.
JOSEPH KLAUDER. Malignant melanomas.
LAWRENCE CURTIS. Plastic procedures of treated carcinoma.
B. P. WIDMANN. Irradiation of superficial intra-oral carcinoma.
JOHN HOWELL. Treatment of carcinoma of rectum.
CHARLES BEHNEY. Carcinoma of ovary.
JOSEPH MCFARLAND. To be announced.
TRUMAN SCHNABEL. Bronchogenic carcinoma.
Staff—2. Symposium on general surgery:
FENWICK BEEKMAN and EDWARD CROSSAN. Present status of the surgical treatment of acute osteomyelitis.
D. B. PFEIFFER. Indications for gastro-enterostomy in the treatment of peptic ulcer.
S. DANA WEEDER and WILLIAM LEMMON. Subtotal gastrectomy for peptic ulcer.
I. S. HNELESKI and ELEANOR VALENTINE—3. Management of blood bank at the Philadelphia General Hospital; demonstration of apparatus, technique of venesection and transfusion, and laboratory studies on refrigerated blood.

PRESBYTERIAN HOSPITAL

ELDRIDGE L. ELIASON, FREDERICK BOTHE, and JOHN PAUL NORTH—9. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

E. T. CROSSAN and staff—9. Operations.

ST. CHRISTOPHER'S HOSPITAL

HARRY E. KNOX, JOHN WOLF, and DR. MARTIN—10. Pediatric surgery.

ST. JOSEPH'S HOSPITAL

C. S. HERRMAN—9. Operations.
L. D. ENGLERTH—10. Operations.
V. R. MANNING—2. Proctological clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL

DESIDERIO ROMAN, R. W. LARER, H. K. ROESSLER, A. W. HAMMER, and staff—9. Operative clinic.
JOHN O. BOWER and staff—9. Dry clinic: A demonstration of the use of 5-0 chromic catgut in pericardectomy and common bile duct, neurorrhaphy and tenorrhaphy.
J. W. POST—9. Demonstration: Roentgenological examinations.
O. F. BARTHMAIER—9. Demonstration: Pathological and bacteriological examinations.

ST. MARY'S HOSPITAL

J. J. TOLAND, JR.—9. Operations.

TEMPLE UNIVERSITY HOSPITAL

W. WAYNE BABCOCK, G. MASON ASTLEY, and J. NORMAN COOMBS—9. Operations.
E. EDWARD CHAMBERLAIN and staff—9. Radiological clinic.
WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. Dry clinic: General and emergency surgery.

U. S. NAVAL HOSPITAL

F. L. CONKLIN, W. T. LINEBERRY, and H. L. PUGH—9. Operations.
J. J. WHITE—9. Demonstration: Kettering-Simpson hypertherm.
J. J. WHITE—1. Demonstration: Kettering-Simpson hypertherm.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—10. Operations: Repair of hernias.
H. WESLEY JACK and staff—1. Operations: Carcinoma of breast; appendectomy.

WOMAN'S HOSPITAL OF PHILADELPHIA

CALVIN M. SMYTH, JR. and staff—9. Operations.

Friday

ABINGTON MEMORIAL HOSPITAL

DAMON B. PFEIFFER, J. WALTER LEVERING, and J. M. DEAVER—2. Operations.

AMERICAN ONCOLOGIC HOSPITAL

JOHN W. BRANSFIELD and GORDON CASTIGLIANO—9:30. Operative and dry clinic: Cancer of breast.

BRYN MAWR HOSPITAL

WALTER E. LEE and T. MCKEAN DOWNS—9. Operations.

COPPER HOSPITAL

PAUL M. MECRAY, I. E. DEIBERT, F. W. SHAFER, and R. S. GAMON—9. Operative clinic: General, abdominal, and thoracic surgery.

FITZGERALD-MERCY HOSPITAL

BASIL R. BELTRAN—9. Operations.
ALEXANDER E. BURKE—9. Operations.

GERMANTOWN HOSPITAL

CHARLES F. MITCHELL, WALTER E. LEE, HARRY E. KNOX, and THOMAS M. DOWNS—10. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WALTER E. LEE—9. Operations.
WALTER E. LEE and HENRY LEROY BOCKUS—11. Gastro-intestinal clinic.

HAHNEMANN HOSPITAL

HENRY S. RUTH—2. Demonstration of sacral caudal block.
JAMES D. SCHOFIELD and staff—2. Operations.

HOSPITAL FOR DISEASES OF STOMACH

HERBERT R. HAWTHORNE, WILBUR W. OAKS, and PAUL H. NEESE—9. Operative and dry clinic.
FRANCIS A. MANTZ—1. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

E. L. ELIASON and staff—9. Gastro-intestinal operations.
E. L. ELIASON—Management of bleeding ulcer cases.
ROBERT B. BROWN—Diagnostic difficulties in colonic lesions.
L. K. FERGUSON. Colonic operations: Surgical diathermy in treatment of rectal disease.
WILLIAM H. ERB. Postoperative care of peptic ulcer cases.
JULIAN JOHNSON. Treatment of acute ileitis.
L. K. FERGUSON and staff—2. Treatment of diseases of the anal canal and rectum.
L. H. HERGESHEIMER. Treatment of hemorrhoids by injection; hemorrhoidectomy in ambulatory patients with local anesthesia.
JOHN B. CLEMENT. Treatment of fissure-in-ano in ambulatory patients by using oil soluble anesthetics.
KENNETH KRESSLER. The treatment of pruritus ani.
JOEL NASS. Treatment of carcinoma of the rectum and of rectal polyps by electrosurgery.
PAUL H. SHIFFER. Nonoperative treatment of ulcerative colitis.
L. K. FERGUSON. One and two stage operations for fistula-in-ano.

JEFFERSON HOSPITAL

GEORGE P. MULLER and staff—9. Dry clinic. Ward walks and case demonstrations.
JAMES SURVER. Pathological demonstration: Small bowel tumors.
GEORGE WILLAUER. Treatment of varicose veins.
HOWARD H. BRADSHAW. Ward rounds.
ROBERT LAYTON and SHERMAN EGER—11. Varicose vein clinic.
GEORGE P. MULLER and staff—11. Operations.
THOMAS A. SHALLOW—11. Operations.
Staff—1. Regular meeting of tumor clinic, department of neoplastic diseases.
J. HALL ALLEN and BENJAMIN HASKELL—1:30. Lesions of the anus and rectum.

JEWISH HOSPITAL

NORMAN S. ROTHSCHILD—9. Operations.
HENRY TUMEN—9. Gastroscopic clinic.

LANKENAU HOSPITAL

GEORGE P. MULLER, GILSON C. ENGEL, JOSEPH O. KEEZEL or HANS MAY—9. Operations. The surgical problems in peptic ulcer. Plastic operations.

MEMORIAL HOSPITAL

JAMES LEHMAN—9. Operations.

MISERICORDIA HOSPITAL

J. A. KELLY and D. C. GEIST—9. Operations.
T. J. RYAN—9. Operations and symposium on peripheral vascular disease.

MOUNT SINAI HOSPITAL

BENJAMIN LIPSHUTZ and LOUIS KAPLAN—9. Operations: Postoperative distention; perforation in appendicitis.
MOSES BEHREND and staff—1:15. Operations.

PENNSYLVANIA HOSPITAL

JOHN B. FLICK and staff—9. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

PATRICK A. MCCARTHY—9. Operative and dry clinic.
B. P. WIDMANN—2. Radium and x-ray therapy.

PRESBYTERIAN HOSPITAL

HENRY P. BROWN and ORVILLE C. KING—9. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

I. M. BOYKIN and staff—9. Operations.

ST. JOSEPH'S HOSPITAL

JAMES A. KELLY—10. Operations.
EDWARD A. MALLON. Historical exhibit commemorating the ninetieth anniversary of St. Joseph's Hospital.

ST. LUKE'S AND CHILDREN'S HOSPITAL

DESIDERIO ROMAN, R. W. LARER, H. K. ROESSLER, A. W. HAMMER and staff—9. Operative clinic.
J. W. POST—9. Roentgenological examinations.
O. F. BARTHMAIER—9. Demonstration: Pathological and bacteriological examinations.

ST. MARY'S HOSPITAL

P. A. MCCARTHY—9. Operations.
J. A. KELLY and E. H. WEISS—9. Operations.

STETSON HOSPITAL

WILLIAM T. ELLIS and J. K. MARKS—12. Operations.
CARL F. KOENIG—2. X-ray clinic.
ROBERT S. ALSTON, C. E. SCHWARTZ, and TROY E. MARTIN—2. Operations.

TEMPLE UNIVERSITY HOSPITAL

W. WAYNE BABCOCK, G. MASON ASTLEY, W. EMORY BURNETT, and J. NORMAN COOMBS—9. Operations.
W. EDWARD CHAMBERLAIN and staff—9. Radiological clinic.
WILLIAM A. STEEL and C. HOWARD MCDEVITT—2. Dry clinic: General and emergency surgery.
CARROLL S. WRIGHT—2. Dermatology and syphilology.
HARRY Z. HIBSHMAN, HARRY E. BACON, and staff—3. Operative and dry clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—10. Operations: Carcinoma of breast.
H. WESLEY JACK and staff—1. Operations: Appendectomies.

WOMAN'S MEDICAL COLLEGE HOSPITAL

HUBLEY R. OWEN—10. Operative clinic: Hernia.
JAMES LEHMAN—10. Operative clinic: Thyroid.
J. STEWART RODMAN—10:30. Operative clinic: Breast.

OBSTETRICS AND GYNECOLOGY

Monday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

Daily Scientific Exhibits:

DOUGLAS P. MURPHY. Tocographic studies of uterine motility during pregnancy and labor.

PAUL O. KLINGENSMITH. Exhibits showing influence of variations in pelvic configuration upon the mechanism of labor.

CARL BACHMAN. Exhibits showing the techniques for the quantitative determination of estrogens and pregnandiol in pregnancy urine.

FRANKLIN L. PAYNE. Hormone studies in hydatidiform mole and chorion epithelioma.

F. SIDNEY DUNNE. Functioning ovarian tumors.

MEMORIAL HOSPITAL

Z. B. NEWTON—2. Gynecological operations.

TEMPLE UNIVERSITY HOSPITAL

HARRY A. DUNCAN—12. Operative and dry clinic.

Obstetrical staff: Daily exhibition and demonstration on fluid balance and weight-control in pregnancy.

WOMAN'S HOSPITAL OF PHILADELPHIA

ELEANOR H. BALPH and staff—1. Urological and gynecological clinic.

Tuesday

BROAD STREET HOSPITAL

N. F. PAXSON and M. J. BENNETT—9. Operative and dry clinics: Ovarian grafting as a therapeutic method for endocrine disorders; presentation of cases of hypermenorrhea and hypo-menorrhea, pre- and postoperative, technique of new method, discussion and illustration by motion pictures in color.

N. F. PAXSON and M. J. BENNETT—2. Operations: Ovarian grafting for hyper- and hypo-menorrhea, 4 cases.

BRYN MAWR HOSPITAL

CHARLES A. BEHNEY—9. Gynecological operations.

COOPER HOSPITAL

T. B. LEE and GORDON F. WEST—9. Operations.

FITZGERALD-MERCY HOSPITAL

JOSEPH V. MISSETT—11. Gynecological operations.

LANKENAU HOSPITAL

E. P. BARNARD—10. Dry clinic:

J. CALVIN HARTMAN. Use of Keilland forceps.

ROSS B. WILSON. Obstetric analgesia.

JULIAN LYON. Care of the premature baby.

HAHNEMANN HOSPITAL

NEWLIN F. PAXSON and HENRY D. LAFFERTY—9. Clinical pathological conference and ward rounds: Chronic nephritis and pregnancy, placenta praevia, x-ray pelvimetry.

HOSPITAL FOR DISEASES OF STOMACH

MARIO A. CASTALLO—11. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

CHARLES C. NORRIS, HOWARD C. TAYLOR, JR., and staff—9. Gynecological operations and demonstrations.

CHARLES C. NORRIS, CHARLES A. BEHNEY, and PENDLETON TOMPKINS—2. Round table discussion: The treatment of cervical carcinoma. George Gray Ward, New York, chairman.

JEANES HOSPITAL

ROSCOE M. TEAHAN, HOKE WAMMOCK, and CLARENCE A. WHITCOMB—9. Operations: Panhysterectomy for carcinoma of uterine fundus; application of radium for carcinoma of cervix; vulvectomy for carcinoma; radical neck dissection for metastatic carcinoma.

JEFFERSON HOSPITAL

P. BROOKE BLAND—9. Gynecological operations.

HARRY STUCKERT—10. Obstetrical ward rounds.

JOHN B. MONTGOMERY—12. Postoperative follow-up clinic.

J. B. BERNSTINE and GEORGE B. BLAND—12. Demonstration of vaccine prevention of puerperal sepsis.

MARIO CASTALLO—12:30. Organization and conduct of obstetrical clinic for treatment of syphilis and gonorrhea complicating pregnancy; results of ten years' experience.

KENSINGTON HOSPITAL FOR WOMEN

E. A. SCHUMANN, ADRIAN VOEGELIN, Z. B. NEWTON, F. J. KOWNACKI, C. T. BEECHAM, and GEORGE C. HANNA, JR.—9. Gynecological operations with special reference to anesthesia. Hysterectomy, avertin; plastic, morphine and scopolamin; laparotomy, ovarian cyst, local; cesarean section, local.

MISERICORDIA HOSPITAL

J. A. SHARKEY—3. Lecture: Postpartum pulmonary complications.

PENNSYLVANIA HOSPITAL

NORRIS W. VAUX and staff—9. Operations and demonstration of cases.

NORRIS W. VAUX and staff—2. Demonstration of Lying-In Hospital technique and procedure:

SPOTSWOOD ROBINS. Admission of patient and assignment to accommodation.

J. VERNON ELLSON. Prenatal care.

CRAIG WRIGHT MUCKLE. Special clinics.

ROBERT M. SHIREY. Preparation of patient for labor.

ROSS B. WILSON—Observation of patient in labor.

CLIFFORD B. LULL. Delivery-room setup, obstetrical technique and procedures.

JOHN C. ULLERY. Care of the patient immediately postpartum.

ROBERT A. KIMBROUGH. Care of the patient throughout puerperium while in the hospital.

F. SIDNEY DUNNE. Follow-up and end-results.

PENDLETON S. TOMPKINS. Out-patient clinic.

RALPH M. TYSON. Care of the newborn.

PHILADELPHIA GENERAL HOSPITAL

C. A. BEHNEY—11. Dry clinic: Tumors in gynecological practice.

PRESBYTERIAN HOSPITAL

GEORGE M. LAWS, JAMES P. LEWIS, and DONALD RIEGEL—2. Gynecological operations.

PRESTON RETREAT

JOHN C. HIRST, ROBERT SHIREY, and ROBERT SHOEMAKER—2. Demonstration of methods, results, and clinical significance of studies in Vitamin A in pregnancy, as

indicated by visual purple estimation from the Feldman adaptometer; surgical demonstration of technique of puerperal sterilization from first to fifth postpartum day by means of Pomeroy tubal-ligation-sterilization through the Pfannenstiel incision under local anesthesia; motion picture in color of the new Pfannenstiel-B. C. Hirst-Kerr extraperitoneal cesarean section, followed by operation if case is available.

ST. LUKE'S AND CHILDREN'S HOSPITAL

WARREN C. MERCER and staff—9. Operative clinic: Supravaginal repairs and vaginal hysterectomies.

ST. VINCENT'S HOSPITAL

WILLIAM F. MORRISON—10. Female gonorrheal clinic: Administering cautery and exhibition of cauterized cases.

STETSON HOSPITAL

STEPHEN E. TRACY and staff—9. Gynecological clinic.

TEMPLE UNIVERSITY HOSPITAL

J. O. ARNOLD—3. Obstetrical clinic, round table discussion.

WOMEN'S HOMEOPATHIC HOSPITAL

F. L. HUGHES—9. Gynecological clinic.

WOMAN'S HOSPITAL OF PHILADELPHIA

MARGARET C. STURGIS and staff—9. Operative and dry clinics: Gynecological sterility.
ALBERTA PELTZ and staff—9. Prenatal clinic.

Wednesday

AMERICAN ONCOLOGIC HOSPITAL

STEPHEN E. TRACY, A. VAUGHAN WINCHELL, and EMMETT F. CICCONE—10. Operative and dry clinic: Cancer of cervix.

BRYN MAWR HOSPITAL

JAMES L. RICHARDS—9. Gynecological operations: Suspension of uterus and hysterectomy.

CHESTNUT HILL HOSPITAL

EDWARD A. SCHUMANN and CLAYTON T. BEECHAM—9:30. Operations.
FRANKLIN L. PAYNE—9. Operations.

FITZGERALD-MERCY HOSPITAL

W. BENSON HARER—9. Gynecological operations.

FRANKFORD HOSPITAL

GEORGE C. HANNA, JR. and WALLACE M. MARTIN—1:30. Operative and dry clinics: Obstetrical.

GERMANTOWN HOSPITAL

E. P. BARNARD and J. CALVIN HARTMAN—9. Operative and dry clinics:
J. CALVIN HARTMAN. Discussion on prenatal care.
Z. B. NEWTON. Operations.
WINSLOW TOMPKINS. Relationship between diet and the anemias of pregnancy.
CHRISTOPHER M. TURMAN. Interpartum separation of the pubic symphysis.
TROY MARTIN. Use of typhoid vaccine in phlebitis.
JOHN W. CUTLER. Signs and symptoms of premature separation not always text book type.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

W. R. NICHOLSON—9. Gynecological operations.

HAHNEMANN HOSPITAL

LEON CLEMMER and NEWLIN F. PAXSON—2. Obstetrical operations.

HOSPITAL FOR DISEASES OF STOMACH

FRANCIS H. EATON—2. Urethral lesions in women.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

CARL E. BACHMAN and staff—9. Obstetrical operations and demonstrations.
DOUGLAS P. MURPHY and PAUL O. KLINGENSMITH—2. Round table discussion: The relative importance of disproportion and inertia uteri in failed trial labor. WILLIAM E. CALDWELL, New York, chairman.

JEFFERSON HOSPITAL

BROOKE M. ANSPACH, JOHN B. MONTGOMERY and staff—9. Operations.
THADDEUS L. MONTGOMERY, MARIO CASTALLO, and CLYDE SPANGLER—9. Operations.
ARTHUR FIRST—12. Endocrine factors in the vitality and development of the fetus.
ABRAHAM RAKOFF—12. New methods in the titration of prolan and estrin; results of such titration in normal and complicated pregnancies.
L. G. FEO—12. Studies in the parasitology and bacteriology of the vagina.
LEOPOLD GOLDSTEIN—12. Glycogen content and acidity of the vagina in pregnancies and its complications.

MEMORIAL HOSPITAL

A. W. VOEGELIN—2. Gynecological operations.

METHODIST EPISCOPAL HOSPITAL

L. C. HAMBLOCK and staff—9. Obstetrical operations and demonstration of Caldwell-Morton apparatus for pelviography.

MOUNT SINAI HOSPITAL

CHARLES MAZER and staff—9. Operations. Exhibition and motion pictures: Investigative problems of the barren marriage.

PENNSYLVANIA HOSPITAL

NORRIS W. VAUX and staff—9. Operations and demonstration of cases.

PHILADELPHIA COUNTY MEDICAL SOCIETY

Demonstration of Committee Activities—4:30. Each committee will take a half hour and discuss three typical deaths in their respective group. Round table discussion.
PHILIP F. WILLIAMS, chairman, Committee on Maternal Welfare.
THADDEUS L. MONTGOMERY, chairman, Committee on the Study of Fetal Deaths.
RALPH TYSON, chairman, Committee on the Study of Neo-Natal Deaths.

PRESBYTERIAN HOSPITAL

CHARLES BEHNEY and JOHN GRIFFITH—9. Gynecological clinic.

ST. JOSEPH'S HOSPITAL

F. H. MAIER—11. Gynecological operations.
HARRY STUCKERT—11. Obstetrical clinic.
J. F. CARROLL—2. Obstetrical clinic.

ST. MARY'S HOSPITAL

L. J. WOJCZYNSKI—9. Gynecological clinic.

P. J. CARRERAS—9. Obstetrical clinic.
J. M. LAFERTY—1. Obstetrical clinic.
W. H. SCHMIDT—Radiological clinic.

TEMPLE UNIVERSITY HOSPITAL

J. O. ARNOLD—3. Obstetrical clinic, round table discussion.

WOMAN'S HOSPITAL OF PHILADELPHIA

ALBERTA PELTZ and staff—9. Prenatal clinic.

Thursday

BROAD STREET HOSPITAL

N. F. PAXSON and M. J. BENNETT—9. Demonstration: New method of studying ovarian activity and the menstrual cycle by means of human vaginal smears. Lantern slide demonstration and visit to laboratory showing technique: Normal cycle; artificial castration; menopause; hypermenorrhea; hypomenorrhea.
N. F. PAXSON and M. J. BENNETT—2. Clinical conference: Ovarian graft as a therapeutic method for endocrine disorders; presenting cases of castration and menopause, postoperative follow-up; discussion of technique used, illustrated by motion pictures in color.

BRYN MAWR HOSPITAL

J. O. GRIFFITHS and J. Y. HOWSON—2. Obstetrical clinic.

COOPER HOSPITAL

T. B. LEE and GORDON F. WEST—9. Operative clinic: Gynecological.
A. B. DAVIS and G. B. GERMAN—2. Operative and dry clinic: Maternal mortality in New Jersey.

FITZGERALD-MERCY HOSPITAL

JOSEPH V. MISSETT—11. Gynecological operations.

HAHNEMANN HOSPITAL

EARL B. CRAIG and FRANK J. FROSCH—9. Operative and dry clinic: Gynecological.
EARL B. CRAIG and FRANK J. FROSCH—2. Operative and dry clinic: Gynecological.

HOSPITAL FOR DISEASES OF STOMACH

TOBY A. GRECO—9. Interposition and Fothergill operations.
J. S. RAUDENBUSH—11. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

CHARLES C. NORRIS, HOWARD C. TAYLOR, JR., and staff—9. Gynecological operations and demonstrations.
FRANKLIN L. PAYNE—2. Round table discussion: The diagnosis and treatment of hydatidiform mole and chorionepithelioma. BENJAMIN P. WATSON, New York, chairman.

JEFFERSON HOSPITAL

LEWIS C. SCHEFFEY, I. CHARLES LINTGEN, and staff—9. Operations.
CLYDE M. SPANGLER—10. Ward rounds.
M. M. GINSBERG—10:30. Cystoscopic clinic.
EDWARD BURT—11. Studies in fetal asphyxia.
THADDEUS L. MONTGOMERY—11. Intrapartum factors in fetal and maternal mortality.
JOHN H. DUGGER—11. A study of rupture of the uterus.
Staff—12. Round table discussion: The practical application of endocrine therapy in gynecological and obstetrical practice. Discussion to be participated in by a number of the leading gynecologists and obstetricians.
I. CHARLES LINTGEN—12. Postoperative follow-up clinic.

BROOKE M. ANSPACH and LEWIS C. SCHEFFEY—3. Clinical conference on gynecology.

MOUNT SINAI HOSPITAL

BERNARD MANN and staff—9. Operations.

NORTHEASTERN HOSPITAL

ALFRED H. DIEBEL—10. Gynecological operations.

PENNSYLVANIA HOSPITAL

NORRIS W. VAUX and staff—9. Operations and demonstration of cases.
NORRIS W. VAUX and staff—2. Demonstration of Lying-In Hospital technique and procedure.
SPOTSWOOD ROBINS. Admission of patient and assignment to accommodation.
J. VERNON ELLSON. Prenatal care.
CRAIG WRIGHT MUCKLE. Special clinics.
ROBERT M. SHIREY. Preparation of patient for labor.
ROSS B. WILSON. Observation of patient in labor.
CLIFFORD B. LULL. Delivery-room setup, obstetrical technique and procedure.
JOHN C. ULLERY. Care of the patient immediately postpartum.
ROBERT A. KIMBROUGH. Care of the patient throughout puerperium while in the hospital.
F. SIDNEY DUNNE. Follow-up and end-results.
PENDLETON TOMPKINS. Out-patient clinic.
RALPH M. TYSON. Care of the newborn.

PHILADELPHIA GENERAL HOSPITAL

EDWARD A. SCHUMANN, JOSEPH MISSETT, JR., WILLIAM ELY, and C. BEECHAM—9. Gynecological operations.

PRESBYTERIAN HOSPITAL

GEORGE M. LAWS and staff—2. Gynecological operations.
PHILIP F. WILLIAMS—2. Demonstration of prenatal clinic.

ST. JOSEPH'S HOSPITAL

WILLIAM J. THUDIUM—11. Operations: Hysterectomy for fibromyoma; Fothergill operation for procidentia.

ST. LUKE'S AND CHILDREN'S HOSPITAL

LEONARD AVERETT and staff—10. Operative clinic: Vaginal approach to pelvic pathology and vaginal hysterectomies; Kerr low cervical cesarean section.

ST. MARY'S HOSPITAL

J. G. SABOL—9. Gynecological clinic.

STETSON HOSPITAL

STEPHEN E. TRACY and staff—9. Gynecological clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

C. F. HADLEY, E. C. HESSERT, and staff—10:30. Gynecological operations.

WOMEN'S HOMEOPATHIC HOSPITAL

W. C. MERCER—9. Gynecological clinic.

WOMAN'S MEDICAL COLLEGE HOSPITAL

FAITH S. FETTERMAN—9. Demonstration of patients and technique: Fulguration treatment of ulcerative submucous cystitis.
MARGARET C. STURGIS—10. Demonstration: Uterosalpingography, technique and evaluation of uterosalpingograms.
CATHARINE MACFARLANE and HELEN INGLEBY—11. Round table conference: Value of periodic pelvic exam-

inations in preventing cancer of the uterus; report on the findings in 1200 volunteers.
CATHARINE MACFARLANE and staff—2. Gynecological operations.

Friday

BROAD STREET HOSPITAL

W. C. MERCER—9. Operations: Uterine fibroid; hysterectomy; anterior and posterior colporrhaphy; uterine suspension.

BRYN MAWR HOSPITAL

JOHN B. MONTGOMERY and THOMAS J. COSTELLO—2. Résumé of obstetrical clinic.

CHESTNUT HILL HOSPITAL

Z. B. NEWTON and H. CURTIS WOOD—11. Operations.

FITZGERALD-MERCY HOSPITAL

W. BENSON HARER—9. Gynecological operations.

HAHNEMANN HOSPITAL

HENRY L. CROWTHER and RICHARD R. GATES—10. Care of premature baby; management of abortion.

HOSPITAL FOR DISEASES OF STOMACH

HARRY STUCKERT—11. Gynecological operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

CARL BACHMAN and staff—9. Obstetrical operations and demonstrations.
PHILIP F. WILLIAMS—12. Round table discussion: Treatment of abortion. FREDERIC J. TAUSSIG, St. Louis, Missouri, chairman.

JEFFERSON HOSPITAL

P. BROOKE BLAND—9. Operations.
JAMES L. RICHARDS, THOMAS J. COSTELLO, and DAVID M. FARRELL—9. Operations.
CLYDE SPANGLER—10. Ward rounds.
LEWIS C. SCHEFFEY and WILLIAM J. THUDIUM—11:30. Uterine cancer follow-up clinic.
JACOB HOFFMAN—12. Endocrinological clinic.
NORRIS W. VAUX and HOBART A. REIMANN—12. Symposium: Pulmonary complications in obstetrical and surgical practice.

KENSINGTON HOSPITAL FOR WOMEN

WALTER M. HEYL—9. Demonstration of the use of a placental blood bank.
MR. STEINBERG and MR. BROWN—9. Demonstration of the principles of blood coagulation and the control of hemorrhages.
E. A. SCHUMANN and staff—9. Obstetrical operations.

MOUNT SINAI HOSPITAL

CHARLES MAZER and staff—9. Operations.

PENNSYLVANIA HOSPITAL

NORRIS W. VAUX and staff—9. Operations and demonstration of cases.

PHILADELPHIA GENERAL HOSPITAL

CHARLES S. MILLER and FRANKLIN F. OSTERHOUT—1. Operative and dry clinic.

ST. JOSEPH'S HOSPITAL

D. S. O'DONNELL—11. Obstetrical clinic.
E. W. GILHOOL—2. Obstetrical clinic.

TEMPLE UNIVERSITY HOSPITAL

HARRY A. DUNCAN—12. Operative and dry clinic: Gynecological.
J. O. ARNOLD—3. Dry clinic and round table discussion: Obstetrics.

WOMAN'S MEDICAL COLLEGE HOSPITAL

ANN GRAY TAYLOR—2. Obstetrical clinic: Abnormal cases.

Days to be Announced

JEWISH HOSPITAL

C. J. STAMM, JACOB WALKER, and PHILIP F. WILLIAMS. Operations.

PRESBYTERIAN HOSPITAL

COLLIN FOULKROD. Operative and dry clinic: Obstetrics.

GENITO-URINARY SURGERY

Monday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

JOSEPH C. BIRDSALL and staff—2. Operative and dry clinic.

ST. JOSEPH'S HOSPITAL

WILLIAM J. EZICKSON—2. Diagnostic clinic.

ST. MARY'S HOSPITAL

W. H. HAINES—1. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

W. HERSEY THOMAS and staff—3. Operative and dry clinic.

Tuesday

GERMANTOWN HOSPITAL

STANLEY Q. WEST and HAROLD S. RAMBO—10. Operative and dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WILLIAM H. MACKINNEY and EDWARD A. MULLEN—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

LEON T. ASHCRAFT and WILLIAM HUNSICKER, JR.—2. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

ALEXANDER RANDALL and staff—2. Operations.

JEFFERSON HOSPITAL

D. M. DAVIS—9. Diagnostic clinic, ward walk.

JEWISH HOSPITAL

JOHN B. LOWNES—9. Operations.
LEON SOLIS-COHEN—9. Urological radiological exhibit.

MOUNT SINAI HOSPITAL

MAURICE MUSCHAT and staff—1:30. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

L. F. MILLIKEN and staff—2. Dry clinic: Plastic surgery of the kidney; demonstration of cases.

TEMPLE UNIVERSITY HOSPITAL

W. HERSEY THOMAS and staff—3. Operative and dry clinic.

U. S. NAVAL HOSPITAL

V. H. CARSON and G. E. GAYLER—9. Operations.
V. H. CARSON and G. E. GAYLER—2. Dry clinic.

Wednesday

ABINGTON MEMORIAL HOSPITAL

ALEXANDER RANDALL and staff—9. Operations.

CHESTNUT HILL HOSPITAL

ALEXANDER RANDALL, FREDERICK S. SCHOFIELD, and FRANK P. MASSANISO—11. Operations.

COOPER HOSPITAL

D. F. BENTLEY and R. BETANCOURT—2. Operative and dry clinic: Prostatic surgery.

GERMANTOWN HOSPITAL

JOHN B. LOWNES, F. S. SCHOFIELD, and FRANK P. MASSANISO—10. Operative and dry clinic.

HAHNEMANN HOSPITAL

LEON T. ASHCRAFT and WILLIAM HUNSICKER, JR.—9. Operations.

JEFFERSON HOSPITAL

D. M. DAVIS and staff—9. Operations.
KARL KORNBLUM—9. Urological radiological cases.

PHILADELPHIA GENERAL HOSPITAL

WILLIAM H. MACKINNEY, W. HERSEY THOMAS, WILLARD H. KINNEY, and EDWARD A. MULLEN—9. Symposium on genito-urinary diseases.

PRESBYTERIAN HOSPITAL

JOSEPH C. BIRDSALL, FRANCIS G. HARRISON, and HENRY SANGREE—2. Operative and dry clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL

E. W. CAMPBELL and staff—9. Operative and dry clinics.

ST. MARY'S HOSPITAL

W. H. HAINES—2. Operations.

Thursday

AMERICAN ONCOLOGIC HOSPITAL

A. E. BOTHE and EMMETT F. CICCONE—10. Operative and dry clinic: Cancer of genito-urinary tract.

CHESTNUT HILL HOSPITAL

FREDERICK S. SCHOFIELD—9. Operations.

GERMANTOWN HOSPITAL

STANLEY Q. WEST and HAROLD S. RAMBO—10. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

ALEXANDER RANDALL and staff—2. Dry clinic:
P. B. HUGHES. Bilateral functional effect of unilateral renal denervation in nephrosis.
S. W. MULHOLLAND. Relationship of urology to the problem of hypertension.
ALEXANDER RANDALL. The etiology of renal calculus.
E. P. PENDERGRASS and P. B. HUGHES. The value of serial pyelography in evaluating the efficiency of urinary transportation.
Staff members. Informative case reports.

JEFFERSON HOSPITAL

D. M. DAVIS and staff—9. Operations.

MEMORIAL HOSPITAL

E. A. MULLEN—3. Operations.

MISERICORDIA HOSPITAL

A. E. BOTHE—2. Operations.

MOUNT SINAI HOSPITAL

MAURICE MUSCHAT and staff—1:30. Operations.

PENNSYLVANIA HOSPITAL

LEON HERMAN and staff—2. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

W. HERSEY THOMAS and staff—3. Operative and dry clinic.

U. S. NAVAL HOSPITAL

V. H. CARSON—2. Dry clinic.

WOMEN'S HOMEOPATHIC HOSPITAL

LEON T. ASHCRAFT—2:30. Operative and dry clinic.

WOMAN'S MEDICAL COLLEGE HOSPITAL

FAITH S. FETTERMAN—9. Operative and dry clinic.

Friday

ABINGTON MEMORIAL HOSPITAL

ALEXANDER RANDALL and staff—9. Operations.

BRYN MAWR HOSPITAL

LEON HERMAN and LLOYD B. GREENE—2. Operations.

GERMANTOWN HOSPITAL

JOHN B. LOWNES, F. S. SCHOFIELD, and FRANK P. MASSANISO—10. Operative and dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

JOSEPH C. BIRDSALL—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

LEON T. ASHCRAFT and WILLIAM HUNSICKER, JR.—9. Operations.

JEFFERSON HOSPITAL

D. M. DAVIS and staff—9. Operations.

JEWISH HOSPITAL

JOHN B. LOWNES—9. Operations.
LEON SOLIS-COHEN—9. Urological radiological exhibit.

METHODIST EPISCOPAL HOSPITAL

STIRLING MOORHEAD and staff—10. Operations.

MISERICORDIA HOSPITAL

A. E. BOTHE—2. Dry clinic: Kidney tumors, types, and treatment.

TEMPLE UNIVERSITY HOSPITAL

W. HERSEY THOMAS and staff—3. Operative and dry clinic.

WOMAN'S HOSPITAL OF PHILADELPHIA

FAITH S. FETTERMAN and staff—9. Urological dry clinic.

FRACTURES AND OTHER TRAUMAS

Monday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. K. FERGUSON, WILLIAM H. ERB, W. D. THOMPSON, and LOUIS KAPLAN—2. Traumatic surgery: Immediate treatment of traumatic wounds; treatment of sprains by injection of local anesthesia; diagnosis and treatment of knee injuries; prophylaxis and treatment of tetanus; prophylaxis and treatment of gas gangrene.

PROTESTANT EPISCOPAL HOSPITAL

I. M. BOYKIN—2. Fractures of lower third of leg, industrial clinic.

Tuesday

ABINGTON MEMORIAL HOSPITAL

DAMON B. PFEIFFER, J. WALTER LEVERING, J. MONTGOMERY DEAVER, and FLETCHER SAIN—3. Fracture clinic: Demonstration of cases, or treatment of compound fractures; fracture dislocation of shoulder; closed skeletal reduction cases, open reduction cases; clinic in operation.

JEWISH HOSPITAL

MOSES BEHREND—9. Dry clinic: Compound fractures, immediate fixation and metal plates.

RALPH GOLDSMITH and staff—9. Fracture clinic.

MISERICORDIA HOSPITAL

F. MOGAVERO—11. Lecture: Experiences with the Smith-Petersen nail.

PRESBYTERIAN HOSPITAL

JOHN PAUL NORTH—9. Industrial surgery clinic.

ST. JOSEPH'S HOSPITAL

J. A. LEHMAN—11. Industrial surgery clinic: Living fascial suture in repair of hernia.

TEMPLE UNIVERSITY HOSPITAL

JOHN ROYAL MOORE—9. Fracture clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

H. WESLEY JACK and staff—1. Operative and dry clinics: Discussion and presentation of 4 cases of removal of spleen following trauma.

Wednesday

COOPER HOSPITAL

Staff—9. Operative and dry clinic.

NORTHEASTERN HOSPITAL

T. TURNER THOMAS—11. Fracture clinic and motion picture demonstration: Shaft and intracapsular fractures of the femur with and without screw fixation; demonstrations of patients, x-rays, and end-results in fractures of tibia and fibula; Pott's fractures with and without posterior dislocation of ankle and marginal fracture of tibia, and fractures of os calcis; fractures and dislocations at shoulder, elbow, and wrist.

PHILADELPHIA GENERAL HOSPITAL

Staff—2. Symposium on fractures:

CLAY MURRAY, S. HUDOCK, HARRISON MCLAUGHLIN. Fractures of the shoulder girdle.

B. F. BUZBY. Fractures about the elbow.

TOM OUTLAND. Fractures of the forearm.

Thursday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

ROBERT A. GROFF—9. Clinical conference: Responsibility of industry in the management of head injuries.

BERNARD D. JUDOVITCH—10. Dry clinic: Back injuries in industrial surgery.

JOHN C. HOWELL—11. Demonstration: Restoration of joint function after fractures; pain in groin following lifting; tendon repair in industrial surgery.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. K. FERGUSON, LOUIS KAPLAN, and L. H. HERGESHEIMER—2. Treatment of fractures in ambulatory patients, clinical demonstration; technique and application of unpadded plaster casts for the upper and lower extremities; reduction of fractures under local anesthesia; practical physiotherapy in fractures by active function; treatment of minor ankle fractures by injection of local anesthesia.

JEWISH HOSPITAL

RALPH GOLDSMITH and staff—9. Fracture clinic.

MEMORIAL HOSPITAL

BRUCE L. FLEMING—9. Fracture clinic.

PENNSYLVANIA HOSPITAL

FREDERICK R. ROBBINS—9. Industrial clinic.

Friday

COOPER HOSPITAL

R. S. GAMON and E. R. RISTINE—9. Dry clinic: Fractures.

ST. MARY'S HOSPITAL

W. J. RYAN—9. Operative and dry clinic: Industrial surgery.

SURGERY OF BONES AND JOINTS

Monday

PROTESTANT EPISCOPAL HOSPITAL

RUTHERFORD L. JOHN—1:30. Orthopedic clinic.

CHILDREN'S HOSPITAL

J. T. NICHOLSON—2. Demonstration of splints. Poliomyelitis: Prevention of foot deformities in younger children by equalization of tendon pull; muscle and fascial transplants.

MOUNT SINAI HOSPITAL

M. B. COOPERMAN—2. Operations.

Tuesday

COOPER HOSPITAL

B. FRANKLIN BUZBY, OSWALD R. CARLANDER, and DR. WALLIS—9. Operative and dry clinics: Elbow injuries; spinal fusion.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

DEFOREST P. WILLARD, JESSE T. NICHOLSON, and BENJAMIN T. BELL—9. Operative and dry clinics: (1) Reconstruction operation in older congenital hip cases; (2) unusual spine lesions responsible for backache; (3) correction of metatarsus varus in hallux valgus.

ST. JOSEPH'S HOSPITAL

PAUL JEPSON—1. Dry clinic: Low back strain; fusion for chronic low back strain.

ST. LUKE'S AND CHILDREN'S HOSPITAL

JOHN A. BROOKE—2. Dry clinic: Tendon transplantation in selected polio cases; arthrodesis of the knee; serratus magnus paralysis with fascial anchorage to the spinous process.

SHRINER'S HOSPITAL

J. R. MOORE—2. Ward walk.

WOMEN'S HOMEOPATHIC HOSPITAL

E. O. GLECKELER—1. Operative and dry clinic.

Wednesday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

W. G. ELMER, L. D. FRESCOLN, and PAUL JEPSON—12. Operations: Arthroplasty, elbows and hips; internal derangement of knees.

JEFFERSON HOSPITAL

J. T. RUGH—9. Operations.

MOUNT SINAI HOSPITAL

M. B. COOPERMAN and staff—2. Operations.

PROTESTANT EPISCOPAL HOSPITAL

J. W. KLOPP—10:30. Operative and dry clinics: Fractures of neck of femur; use of nailing in treatment.
RUTHERFORD L. JOHN—1:30. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

RUTHERFORD L. JOHN—10:30. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

PAUL JEPSON—10. Operative clinic: Internal derangement of knee, exploration; polydactylia, plastic surgical result; nailing of fractured hip.

SHRINER'S HOSPITAL

J. R. MOORE—9. Operations.

U. S. NAVAL HOSPITAL

C. F. MORRISON—9. Operations.

WEST JERSEY HOMEOPATHIC HOSPITAL

S. L. BROWN and staff—9. Operations.

Thursday

BRYN MAWR HOSPITAL

GEORGE WAGONER—9. Operations: Demonstration of selected cases of healed fractures.

GERMANTOWN HOSPITAL

B. FRANKLIN BUZBY and A. D. WALLIS—9. Operative and dry clinic.

HAHNEMANN HOSPITAL

JOHN A. BROOKE, EDWIN GECKELER, and DONALD T. JONES—2. Dry clinic: Fractures of neck of femur, internal fixation, Smith-Petersen pin or parallel screws; results of leg shortening; herniation of intervertebral disc; shoulder disabilities; orthopedic problem cases for discussion.

PHILADELPHIA ORTHOPAEDIC HOSPITAL

DEFOREST P. WILLARD and staff—9. Case demonstrations: Treatment of Legg Calvé Perthes disease; five year results of slipped femoral epiphysis; decompression of abscess for paraplegia in Pott's disease.

ST. JOSEPH'S HOSPITAL

PAUL JEPSON—1. Operation: Fusion for chronic low back strain.

SHRINER'S HOSPITAL

J. R. MOORE—9. Demonstration of out-patient clinic.

TEMPLE UNIVERSITY HOSPITAL

JOHN ROYAL MOORE—1. Operations.

U. S. NAVAL HOSPITAL

C. F. MORRISON—2. Dry clinic.

Friday

COOPER HOSPITAL

B. FRANKLIN BUZBY, OSWALD R. CARLANDER, and DR. WALLIS—9. Operative and dry clinic: Knee injuries.

JEWISH HOSPITAL

A. M. RECHTMAN, E. A. BRAV, HENRY SIGMOND, and M. T. HORWITZ—9. Dry clinic: Arthroplasty and resection of the elbow; malignant tumors; backache; lesions of the knee joint.

MOUNT SINAI HOSPITAL
M. B. COOPERMAN and staff—2. Operations.

ST. CHRISTOPHER'S HOSPITAL
RUTHERFORD L. JOHN—10:30. Operations.

SHRINER'S HOSPITAL
J. R. MOORE—9. Operations.

Days to be Announced

PRESBYTERIAN HOSPITAL
BRUCE GILL. Operative and dry clinic.

NEUROSURGERY

Tuesday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
FRANCIS C. GRANT and staff—9. Operative and dry clinic: Major trigeminal neuralgia (motion pictures).

JEFFERSON HOSPITAL
WILLIAM DUANE, JR.—9. Operations.

TEMPLE UNIVERSITY HOSPITAL
TEMPLE S. FAY—9. Operations.

Wednesday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
FRANCIS C. GRANT and staff—9. Dry clinic: Motion picture demonstration of the treatment of spinal cord injuries.

MISERICORDIA HOSPITAL
T. J. RYAN—9. Operative and dry clinic: Craniocerebral injuries.

TEMPLE UNIVERSITY HOSPITAL
TEMPLE S. FAY—9. Operations.

Thursday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
FRANCIS C. Grant and staff—9. Craniotomy for a brain tumor.

JEFFERSON HOSPITAL
WILLIAM DUANE, JR.—9. Operations.

Friday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
FRANCIS C. GRANT and staff—9. Dry clinic: Diagnosis and treatment of pituitary disease.

JEFFERSON HOSPITAL
BERNARD J. ALPERS and WILLIAM DUANE, JR.—10. Brain tumors, diagnosis and treatment.

TEMPLE UNIVERSITY HOSPITAL
TEMPLE S. FAY—9. Operations.

PLASTIC AND FACIOMAXILLARY SURGERY

Monday

CHESTNUT HILL HOSPITAL
CHARLES W. GAISER—2. Operations.

NORTHERN LIBERTIES HOSPITAL
SAMUEL COHEN—2. Nasal plastic surgery.

Tuesday

JEFFERSON HOSPITAL
WARREN B. DAVIS—9. Operations.

PENNSYLVANIA HOSPITAL
JAMES R. CAMERON—2. Operations.

PRESBYTERIAN HOSPITAL
ROBERT IVY, LAWRENCE CURTIS, and HENRY A. MILLER—9. Operative and dry clinic: Facial reconstructions.

Wednesday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
SAMUEL COHEN—3. Nasal plastic operation.

Thursday

AMERICAN ONCOLOGIC HOSPITAL
GEORGE M. DORRANCE and JOHN W. BRANSFIELD—11. Dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
EDMUND B. SPAETH—2. Plastic surgery of the eye.

JEFFERSON HOSPITAL
WARREN B. DAVIS—9. Operations.

Friday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
ROBERT H. IVY, LAWRENCE CURTIS, and HENRY A. MILLER—9. Operations.

HAHNEMANN HOSPITAL
THOMAS L. DOYLE—9. Operations.

MOUNT SINAI HOSPITAL
V. Frank—2. Operations.

ST. JOSEPH'S HOSPITAL
WILLIAM J. MCKINLEY—9. Operative and dry clinic.

THORACIC SURGERY

Tuesday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

I. S. RAVDIN and staff—2. Dry clinic:
RICHARD H. MEADE. The surgical treatment of pulmonary tuberculosis.
GABRIEL TUCKER. The bronchoscopic aspects of thoracic surgery.
JULIAN JOHNSON. The surgical treatment of pulmonary malignancy and bronchiectasis.

JEFFERSON HOSPITAL

HOWARD H. BRADSHAW and GEORGE WILLAUER—11:30. Dry clinic: Thoracic diseases.

PHILADELPHIA GENERAL HOSPITAL

Staff—9. Symposium on empyema, atelectasis sulfapyridine:
E. L. ELIASON. Empyema results.
E. BURVILLE-HOLMES. Roentgenological aspects of empyema.
LEON SCHWARTZ. Clinical studies on sulfapyridine.
V. W. MURRAY WRIGHT. Basal atelectasis following general surgical operations.
MOSES BEHREND, RICHARD H. MEADE, JR., RUBIN M. LEWIS, and ALBERT BEHREND—2. Operative and dry clinics: Phrenic nerve operations; pneumolysis; thoracoplasty; extrapleural pneumothorax.

Wednesday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WALTER E. LEE—10. Constrictive pericarditis.

JEFFERSON HOSPITAL

HOWARD H. BRADSHAW and GEORGE WILLAUER—2. Operative clinic: Thoracic diseases.

PENNSYLVANIA HOSPITAL

JOHN B. FLICK and staff—9. Operative and dry clinic.
JOHN T. BAUER—3. Dry clinic: Carcinoma of the lung, diagnosis by sputum examination.

PROTESTANT EPISCOPAL HOSPITAL

RICHARD H. MEADE—9. Operative and dry clinic: Thoracoplasty for pulmonary tuberculosis.

Thursday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

J. W. CUTLER—2. Operations: Extrapleural and intrapleural pneumolysis in surgical therapy of tuberculosis.

TEMPLE UNIVERSITY HOSPITAL

W. EMORY BURNETT—9. Operative clinic.
Staff—2. Dry clinic: Thoracic diseases (chest conference).

BRONCHO-ESOPHAGOLOGY

(See also clinical schedules under Otorhinolaryngology)

Monday

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON and staff—1. Broncho-esophagological clinic: Bronchoscopy as an aid to the thoracic surgeon.

Tuesday

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Direct laryngoscopy.
GABRIEL TUCKER—2. Dry clinic: Laryngeal tumors, benign and malignant; demonstration of patients and colored motion pictures on the technique of direct laryngoscopy, laryngofissure and laryngectomy.

JEWISH HOSPITAL

LOUIS H. CLERF, R. M. LUKENS, and C. J. SWALM—3. Bronchoscopic clinic.

PHILADELPHIA GENERAL HOSPITAL

GEORGE L. WHELAN—9. Bronchoscopic clinic.

PROTESTANT EPISCOPAL HOSPITAL

WILLIAM A. LELL—2. Bronchoscopic clinic: Motion picture demonstration, "The Larynx."

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON—11. Dry clinics: Diseases of the esophagus; diverticulum of the hypopharynx and one stage operation for its surgical cure (motion pictures).

Wednesday

JEFFERSON HOSPITAL

LOUIS H. CLERF—9. Bronchoscopic clinic.

MISERICORDIA HOSPITAL

GABRIEL TUCKER, JOSEPH P. ATKINS, and WILLIAM A. LELL—2. Operative and dry clinic.

MOUNT SINAI HOSPITAL

W. A. LELL and staff—10. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

LOUIS H. CLERF—1. Bronchoscopic clinic: Malignant tumors.

WOMAN'S MEDICAL COLLEGE HOSPITAL

EMILY VAN LOON and associates—9. Bronchoscopic clinic.

Thursday

FRANKFORD HOSPITAL

GEORGE A. RICHARDSON—1:30. Bronchoscopic clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Bronchoscopic clinic.

JEFFERSON HOSPITAL

LOUIS H. CLERF—1. Bronchoscopic clinic.

NORTHERN LIBERTIES HOSPITAL

N. M. LEVIN—9. Bronchoscopic clinic.

PHILADELPHIA GENERAL HOSPITAL

GEORGE WHELAN—9. Bronchoscopic clinic.

ST. CHRISTOPHER'S HOSPITAL

EMILY VAN LOON—9. Bronchoscopy in allergic children.

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON and staff—2:30. Broncho-esophagological clinic. 4:30. Chest conference.

U. S. NAVAL HOSPITAL

F. HARBERT—2. Bronchoscopic clinic.

Friday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER and WALTER E. LEE—10. Surgical management of esophageal diverticula.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Bronchology and esophagology.

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON and WILLIAM A. SWALM—11. Gastroscopic clinic.

OTORHINOLARYNGOLOGY

(See also clinical schedules under Broncho-Esophagology)

Monday

BRYN MAWR HOSPITAL

EDWIN P. LONGAKER—2. Operations.

CHILDREN'S HOSPITAL

WILLIAM HEWSON—1. Dry clinic: Sinus infections in children, diagnosis, and treatment.

LLOYD S. HUTCHINSON and MALCOLM N. WILMES—3. Operations: Tonsillectomy in children.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

RALPH BUTLER and WALTER ROBERTS—2. Operative and dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

HARRY P. SCHENCK and LOUIS E. SILCOX—2. Operations. Staff—2. Dry clinic:

DELAZON BOSTWICK. Notes on septal surgery.

JULIUS WINSTON. Neuro-otological clinic.

L. E. SILCOX. Subluxation of the nasal septum.

J. C. DONNELLY. Audible tinnitus; presentation of patients.

H. P. SCHENCK. Carcinoma of the nasal septum.

KARL M. HOUSER. Submucous resection of the nasal septum.

JEWISH HOSPITAL

H. M. GODDARD—2. Operations: Submucous resection; tonsillectomy; maxillary sinus.

MOUNT SINAI HOSPITAL

M. S. ERSNER—2:30. Operations.

PENNSYLVANIA HOSPITAL

WILLIAM HEWSON and THOMAS GOWEN—2. Operations.

EDWARD H. CAMPBELL—2. Diagnostic methods in nose and throat conditions.

PHILADELPHIA GENERAL HOSPITAL

HERBERT M. GODDARD—2. Tonsil and submucous clinic.

PRESBYTERIAN HOSPITAL

WALTER L. CARISS, DOUGLAS MACFARLAN, RICHARD W. GARLICHS, and E. W. KEMNER—2. Operative and dry clinic.

ST. JOSEPH'S HOSPITAL

T. F. GOWEN—1. Operative and dry clinic.

ST. MARY'S HOSPITAL

E. J. MURPHY—1. Operations.

TEMPLE UNIVERSITY HOSPITAL

ROBERT F. RIDPATH and staff—2. Rhinological clinic.

WOMAN'S HOSPITAL OF PHILADELPHIA

HENRIETTA T. TANNER—2. Operations: Tonsillectomy and adenoidectomy.

Tuesday

COOPER HOSPITAL

ORAM R. KLINE, ERNEST R. HIRST, and staff—2. Operations.

FITZGERALD-MERCY HOSPITAL

CORNELIUS T. MCCARTHY—1. Radical mastoidectomy, report on three cases of lateral sinus thrombosis with recovery. Treatment of otolaryngological cases with sulfanilamide.

FRANKFORD HOSPITAL

ROBERT WATT—1:30. Operative and dry clinic.

GERMANTOWN HOSPITAL

H. J. WILLIAMS, C. B. OWINGS, C. E. TOWSON, VALENTINE MILLER, and WILLIAM HITSCHLER—2. Operative and dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GEORGE M. COATES and BENJAMIN H. SHUSTER—2. Operative and dry clinics: Otolaryngology and neurotology.

HAHNEMANN HOSPITAL

CHARLES B. HOLLIS—2. Operations.

HOSPITAL FOR DISEASES OF STOMACH

ROBERT J. HUNTER—2. Functional ear test.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GABRIEL TUCKER, WILLIAM A. LELL, and J. P. ATKINS—9. Direct laryngoscopy.

JULIUS WINSTON and D. S. BOSTWICK—2. Operations.
GABRIEL TUCKER—2. Dry clinic: Laryngeal tumors, benign and malignant; demonstration of patients and colored motion pictures on the technique of direct laryngoscopy, laryngofissure, and laryngectomy.
Staff—2. Dry clinic: Surgical treatment of deafness.
EDWARD H. CAMPBELL. New surgical treatment of conductive deafness.
OSCAR BATSON. Anatomical considerations.
WALTER HUGHSON. Surgery of deafness.
JAMES A. BABBITT. Newer phases of otosclerosis.
D. W. BRONK. Excitation of sensory nerves by normal and pathological processes.

JEFFERSON HOSPITAL

LOUIS H. CLERF—9. Cancer of larynx.
H. H. LOTT—9. Tonsil clinic.
H. J. WILLIAMS—1. Dry clinic: Facial paralysis occurring during the course of chronic suppurative otitis media, and its treatment.

LANKENAU HOSPITAL

EDWARD H. CAMPBELL—2. Otolaryngological clinic.

METHODIST EPISCOPAL HOSPITAL

WALTER ROBERTS and staff—2. Operations.

MISERICORDIA HOSPITAL

R. J. BRENNAN—2. Lecture: Treatment of sinusitis.

MOUNT SINAI HOSPITAL

D. N. HUSIK—1:30. Operations.

PENNSYLVANIA HOSPITAL

ORAM KLINE, HENRY A. MILLER, and HOWARD HEBBLE—2. Operations.
ROMEO A. LUONGO and ANTHONY C. BRANCATO—2. Dry clinic: Diagnostic methods in nose and throat conditions.
LOUIS E. SILCOX—2. Operations: Tonsillectomy, general anesthesia.

PHILADELPHIA GENERAL HOSPITAL

LOUIS J. BURNS—2. Laryngeal tuberculosis.

ST. JOSEPH'S HOSPITAL

ARTHUR WRIGLEY—11. Operative and dry clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL

SETH BRUMM and staff—2. Operative clinic.

ST. MARY'S HOSPITAL

W. P. GRADY—9. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

MATTHEW S. ERSNER, EDWARD K. MITCHELL, S. BRUCE GREENWAY, and DAVID MYERS—2. Otological clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

E. S. HALLINGER and staff—2. Operations.

Wednesday

CHESTNUT HILL HOSPITAL

JOHN R. DAVIES, JR., GEORGE T. FARIS, and DARIUS G. ORNSTON—1:30. Operations.

CHILDREN'S HOSPITAL

F. HAROLD KRAUSS—1. Sinus infections in children, diagnosis and treatment; tonsil and mastoid operations.

FITZGERALD-MERCY HOSPITAL

J. E. LOFTUS—1. Mastoid operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

GEORGE B. WOOD—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

JOSEPH V. CLAY—2. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

EDWARD H. CAMPBELL and OSCAR V. BATSON—2. Operations.
Staff—2. Dry clinic: Chemotherapy in otolaryngology.
D. SERGEANT PEPPER. Limitations of chemotherapy.
H. F. FLIPPIN. Chemotherapy in meningitis.
THOMAS FITZ-HUGH, JR. Hematological effects of drug therapy.
HARRY P. SCHENCK. Procedures supplementing chemotherapy.
KARL M. HOUSER. Chemotherapy in otolaryngology.
E. P. PENDERGRASS. Effects of chemotherapy upon roentgenological findings.

JEFFERSON HOSPITAL

A. T. SMITH—10. Tumors of nose and sinuses.
H. J. WILLIAMS—1. Operative and dry clinic.

JEWISH HOSPITAL

A. S. KAUFMAN—1. Mastoid operations.

MISERICORDIA HOSPITAL

C. T. MCCARTHY—2. Operations: Tonsillectomy, local, LaForce, dissection; submucous resection; simple and radical mastoid; results of sulfanilamide in mastoiditis.

PHILADELPHIA GENERAL HOSPITAL

ROBERT J. HUNTER—2. Recent advances of otology; ward walks.

PROTESTANT EPISCOPAL HOSPITAL

ALLEN BERTOLET and staff—2. Operations.

ST. CHRISTOPHER'S HOSPITAL

HAROLD KRAUSS and GOMER T. WILLIAMS—2. Operations.

ST. JOSEPH'S HOSPITAL

R. L. DICKSON—11. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

GEORGE MACKENZIE and staff—2. Demonstration of cases: Radical mastoids.

STETSON HOSPITAL

C. H. GRIMES and staff—12. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

ROBERT F. RIDPATH and staff—2. Rhinological clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

E. S. HALLINGER and staff—2. Operations.

WOMAN'S HOSPITAL OF PHILADELPHIA

CATHERINE ARTHURS and staff—2. Operations.

Thursday

BRYN MAWR HOSPITAL

CHARLES A. PRYOR—2. Operations.

FITZGERALD-MERCY HOSPITAL

CORNELIUS T. MCCARTHY—1. Operations.

GERMANTOWN HOSPITAL

H. J. WILLIAMS, C. B. OWINGS, C. E. TOWSON, VALENTINE MILLER, and WILLIAM HITSCHLER—2. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

RALPH BUTLER and WALTER ROBERTS—2. Operative and dry clinic.

HAHNEMANN HOSPITAL

CHARLES B. HOLLIS—2. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

J. C. DONNELLY and HARRY SCHLUDERBERG—2. Operations.

Staff—2. Dry clinic.

VALENTINE MILLER. Demonstration: Loose areolar tissue of the larynx.

J. C. DONNELLY. Allergy of the upper respiratory tract and its relation to bronchiectasis.

FREDERICK H. KRAUSS. New method of tonsillectomy under vinethene anesthesia.

ROBERT J. HUNTER. Interpreting tuning fork time in decibels.

FRANCIS C. GRANT. Otitic brain abscess.

ELLIOTT CLARK and RICHARD ABELL. Studies of reactions in living tissue.

JEFFERSON HOSPITAL

A. T. SMITH—9. Tonsil clinic.

A. T. SMITH—1. Sinus clinic.

JEWISH HOSPITAL

H. B. COHEN—1. Operations.

MEMORIAL HOSPITAL

H. J. WILLIAMS—2. Radical mastoid operations.

METHODIST EPISCOPAL HOSPITAL

WALTER ROBERTS and staff—2. Operations.

MISERICORDIA HOSPITAL

J. E. LOFTUS—2. Dry clinic: Mastoid surgery.

MOUNT SINAI HOSPITAL

MORRIS A. WEINSTEIN—2. Operations.

PENNSYLVANIA HOSPITAL

WILLIAM HEWSON, ORAM KLINE, and ROMEO LUONGO—2. Operations.

WILLIAM HEWSON, HOWARD HEBBLE, and LOUIS E. SILCOX—2. Dry Clinic: Diagnostic methods in nose and throat conditions.

EDWARD H. CAMPBELL—2. Mastoid operations.

PHILADELPHIA GENERAL HOSPITAL

BENJAMIN H. SHUSTER—2. Laryngeal tuberculosis.

PROTESTANT EPISCOPAL HOSPITAL

OTTO C. HIRST and staff—2. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

WILLIAM WHELAN, BENJAMIN SHUSTER, and staff—2. Lantern slide demonstration showing patients before and after radical operation for disease of the frontal, ethmoid and maxillary sinuses, with proptosis of the eye ball.

ST. MARY'S HOSPITAL

E. J. HOLLAND—1. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

CHEVALIER L. JACKSON and W. WAYNE BABCOCK—1. Dry clinic: Surgical treatment of cancer of the larynx, laryngofissure, and laryngectomy.

N. M. LEVIN—1. Teaching the laryngectomized patient to talk.

MATTHEW S. ERSNER and staff—2. Otological clinic: Demonstration of cases where labyrinthian fenestrations were performed for the relief of deafness.

U. S. NAVAL HOSPITAL

T. S. MORING, C. W. STELLE, and F. HARBERT—9. Operative and dry clinic.

WEST JERSEY HOMEOPATHIC HOSPITAL

E. S. HALLINGER and staff—2. Operations.

Friday

CHILDREN'S HOSPITAL

EDWARD H. CAMPBELL—1. Dry clinic: Sinus infections in children, diagnosis and treatment; mastoid operations.

FITZGERALD-MERCY HOSPITAL

J. E. LOFTUS—1. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

KARL M. HOUSER and E. W. KEMNER—2. Operations.

LANKENAU HOSPITAL

EDWARD H. CAMPBELL—2. Otolaryngological clinic.

PENNSYLVANIA HOSPITAL

THOMAS GOWEN and HENRY A. MILLER—2. Operations.

THOMAS GOWEN and EDWARD J. GOUGH—2. Dry clinic: Diagnostic methods in nose and throat conditions.

THOMAS GOWEN and WILLIAM DANEHOWER—2. Operations: Tonsillectomy and mastoidectomy.

PHILADELPHIA GENERAL HOSPITAL

DAVID N. HUSIK—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

HAROLD KRAUSS and GOMER T. WILLIAMS—10. Operations.

ST. MARY'S HOSPITAL

T. J. WALSH—1. Operative and dry clinic.

WOMEN'S HOMEOPATHIC HOSPITAL

J. R. CRISWELL—2. Operative and dry clinic.

Days to be Announced

ABINGTON MEMORIAL HOSPITAL

WALTER HUGHSON. Demonstration: Physiology of hearing.

FREDERICK KRAUSS. Discussion of mastoids.

OPHTHALMOLOGY

Monday

COOPER HOSPITAL

J. S. SHIPMAN and staff—2. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. C. PETER and staff—2. Dry clinic.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS HEED ADLER—2. Operative and dry clinic.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

LANKENAU HOSPITAL

PERCE DELONG—2. Ophthalmological clinic.

MOUNT SINAI HOSPITAL

AARON BARLOW—4. Operations.

PENNSYLVANIA HOSPITAL

A. G. FEWELL—2. Fundus clinic.

PRESBYTERIAN HOSPITAL

H. M. LANGDON—2:30. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

ANDREW KNOX—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

J. B. FELDMAN—2. Squint clinic.

TEMPLE UNIVERSITY HOSPITAL

WALTER I. LILLIE and staff—1. Operative and dry clinic.

WILLS HOSPITAL

J. M. GRISCOM, F. C. PARKER, and T. A. O'BRIEN—2. Operative and dry clinic.

Tuesday

CHESTNUT HILL HOSPITAL

GEORGE E. BERNER—2. Operations.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WILLIAM T. SHOEMAKER—2. Operative and dry clinic.

HOSPITAL FOR DISEASES OF STOMACH

GEORGE H. DENNEY—1. Cataract cases.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

PHILADELPHIA GENERAL HOSPITAL

C. R. MULLEN—3. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

N. M. BRINKERHOFF—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

J. B. FELDMAN—2. Squint clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL

F. C. PETERS, S. H. BROWN, and staff—2. Operative clinic.

ST. MARY'S HOSPITAL

F. A. MURPHY—1. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL

WALTER I. LILLIE and staff—1. Operative and dry clinic.

WILLS HOSPITAL

LOUIS LEHRFELD, W. S. REESE, and C. R. MULLEN—2. Operative and dry clinic.

Wednesday

BRYN MAWR HOSPITAL

T. DELORME FORDYCE—2. Operative and dry clinic.

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

L. C. PETER and staff—2. Operations.

GERMANTOWN HOSPITAL

CARL WILLIAMS and ALBERT C. SAUTTER—10. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

FRANCIS HEED ADLER—2. Operative and dry clinic.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

LANKENAU HOSPITAL

PERCE DELONG—2. Ophthalmological clinic.

PRESBYTERIAN HOSPITAL

H. M. LANGDON—2:30. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

ANDREW KNOX—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL

J. B. FELDMAN—3. Operations.

ST. LUKE'S AND CHILDREN'S HOSPITAL

F. C. PETERS, S. H. BROWN, and staff—2. Operative clinic.

WILLS HOSPITAL

JAMES S. SHIPMAN, EDMUND B. SPAETH, and WILLIAM J. HARRISON—2. Operative and dry clinic.

Thursday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA

WILLIAM T. SHOEMAKER—2. Operative and dry clinic.

JEFFERSON HOSPITAL

C. E. G. SHANNON—2. Operative and dry clinic.

MOUNT SINAI HOSPITAL

AARON BARLOW—4. Operations.

PHILADELPHIA GENERAL HOSPITAL

C. R. MULLEN—3. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL

N. M. BRINKERHOFF—2. Operative and dry clinic.

ST. CHRISTOPHER'S HOSPITAL
J. B. FELDMAN—2. Squint clinic.

ST. LUKE'S AND CHILDREN'S HOSPITAL
F. C. PETERS, S. H. BROWN, and staff—9. Operations.

ST. MARY'S HOSPITAL
R. T. M. DONNELLY—10. Operations.

TEMPLE UNIVERSITY HOSPITAL
WALTER I. LILLIE and staff—1. Operative and dry clinic.

U. S. NAVAL HOSPITAL
T. S. MORING, C. W. STELLE, and F. HARBERT—9. Operative and dry clinic.

WILLS HOSPITAL
J. M. GRISCOM, F. C. PARKER, and T. A. O'BRIEN—2. Operative and dry clinic.

Friday

GRADUATE HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
L. C. PETER and staff—2. Dry clinic.

HAHNEMANN HOSPITAL
FREDERICK C. PETERS and staff—2. Operations.

HOSPITAL OF UNIVERSITY OF PENNSYLVANIA
FRANCIS HEED ADLER—2. Operative and dry clinic.

JEFFERSON HOSPITAL
C. E. G. SHANNON—2. Operative and dry clinic.

PENNSYLVANIA HOSPITAL
A. G. FEWELL—2. Fundus clinic.

PRESBYTERIAN HOSPITAL
H. M. LANGDON—2:30. Operative and dry clinic.

PROTESTANT EPISCOPAL HOSPITAL
ANDREW KNOX—2. Operative and dry clinic.

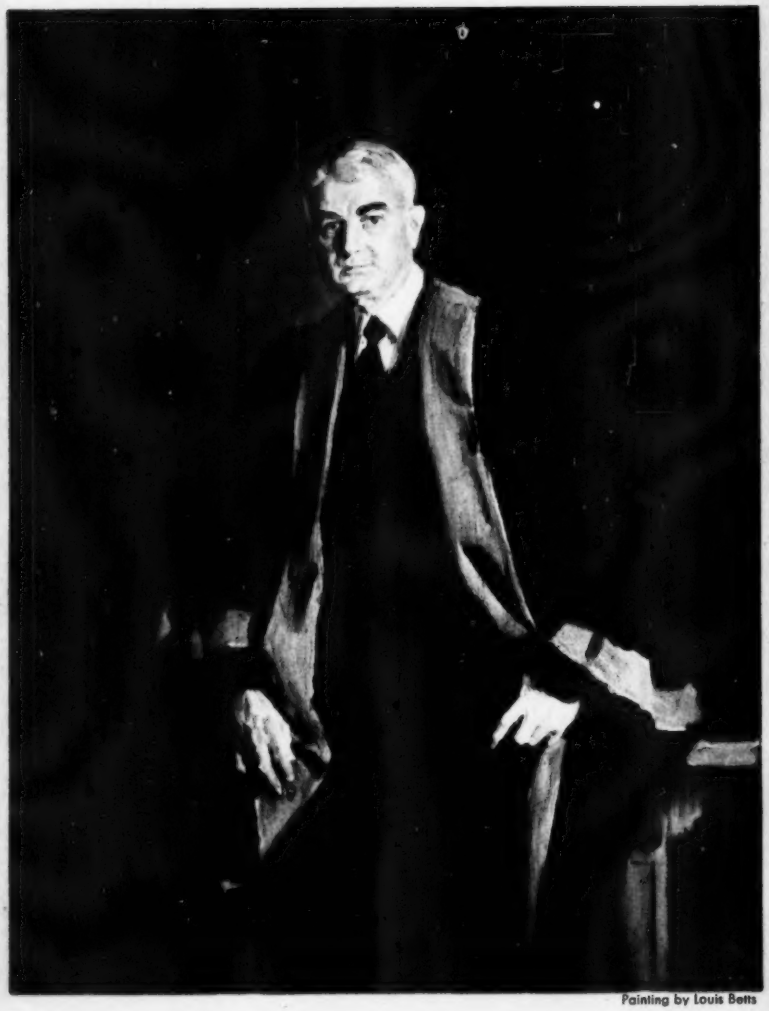
ST. CHRISTOPHER'S HOSPITAL
J. B. FELDMAN—2. Squint clinic.

ST. JOSEPH'S HOSPITAL
THOMAS O'BRIEN—4. Operative and dry clinic.

TEMPLE UNIVERSITY HOSPITAL
WALTER I. LILLIE and staff—1. Operative and dry clinic.

WILLS HOSPITAL
LOUIS LEHRFELD, W. S. REESE, and C. R. MULLEN—2. Operative and dry clinic.

WOMEN'S HOMEOPATHIC HOSPITAL
C. J. V. FRIES—2. Operative and dry clinic.



Painting by Louis Betts

WILLIAM J. MAYO

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